

**PERCEPTION OF AGRO-PASTORALISTS TOWARDS THE INFLUENCE OF
SOCIAL AND ECONOMIC FACTORS ON SWEET POTATO PRODUCTION IN
PORO WARD, SAMBURU COUNTY, KENYA**

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**A Thesis Submitted to Graduate School in Partial Fulfilment of Requirements for the
Master of Science Degree in Community Studies and Extension of Egerton University**

EGERTON UNIVERSITY

JULY, 2023

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented in this university or any other for the award of a degree.

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Recommendation

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DEDICATION

To agro pastoralists in Poro ward, my late mother in-law, Ntikilten Lepariyo; my mother, Mary Koech; my siblings and my children.

ACKNOWLEDGEMENTS

I thank God for guiding me through the whole process of proposal inception, development, up to the thesis. A lot of thanks to Egerton University for offering me the admission to pursue a degree in MSc. Community Studies and Extension. I will not forget to thank the Egerton University library staff for their support in access to research materials. My gratitude to my supervisors; Dr. Catherine N. Munyua and Dr. Adijah M. Olubandwa for their professional guidance, support, and advice from proposal inception to thesis write up. I wish to appreciate my colleagues, especially Colleta Awino at Egerton University for their contribution to this work. I would also like to thank the family of Prof. Kibet Ngetich and Dr. Emily Ngetich, my family, my husband, Partamei, our children Naresian, Naisula, Biko, Saewua and Saitoip for their endless prayers, financial and moral support, while I pursued my studies. Finally, to all those who had input in this work from its inception to the final writing of the thesis, that I may not have mentioned above, thank you so much for your support. None of this would have been possible without you.

ABSTRACT

Sweet potato is one of the world's highest-yielding crop in terms of production per unit area, exceeding that of major cereal like rice. In Kenya, sweet potato production has been on the rise with the acreage under sweet potato rapidly increasing in recent years. World Vision introduced 7,800 sweet potato vines in Poro ward in 2010 and 2011 to 5 agro-pastoralists groups to, bulk and share with others to enhance food and nutrition security at household level. The main problem amongst agro pastoralists was low production of the crop. The purpose of the study was to investigate the perception of agro pastoralists towards influence of social and economic factors on sweet potato production. The study investigated three independent variables, namely influence on social factors, economic factors. The dependent variable was sweet potato production. Descriptive survey design was used to conduct this study with a sample size of 100. Data was collected through questionnaire administered to 100 agro pastoralists, through Focus Group Discussion (FGD) of opinion leaders and Key Informant Interviews (KII) of extension agents. Experts in the Department of Applied Community Development Studies determined the validity of research instruments. A pilot study was carried out with agro pastoralists in Lodokejek ward to determine reliability of the research instruments where reliability was 0.746. Data was analysed using descriptive statistics such as percentages and frequency distributions. The Statistical Package for Social Sciences (SPSS) was used to analyse the data. The study found that 63 percent of the respondents did not have any formal education. While 91.9 percent of the respondents indicated to have received sweet potato vines from World Vision only 43.56 percent of the population planted sweet potatoes for four years. Contrary to initial studies on social factors, community traditions and norms did not hinder sweet potato production – rather, low crop acreage was attributed to prolonged drought and use of vines as livestock feeds. This indicates that agro pastoralists valued livestock more than sweet potato production. Further the study found that only few agro pastoralists were trained on agronomic traits of the sweet potatoes and the perception of extension agents was that the crop was still new. These factors could have potentially limited uptake. This study concludes that although sweet potato is a multipurpose crop and has potential to improve food and nutrition security for agro pastoralists, Samburu agro pastoralists still depend on livestock for their livelihood. However, to increase adoption, the study recommends exploring the potential of a dual-purpose sweet potato crop that could be used for human consumption and livestock feeds.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	: Acquired Immunodeficiency Syndrome
DoA	: Department of Agriculture
DoL	: Department of Livestock
HIV	: Human Immunodeficiency Virus
KALRO	: Kenya Agricultural and Livestock Research Organization
LDA	: Limpopo Department of Agriculture
NACOSTI	: National Commission for Science Technology and Innovation
NALEP	: National Agricultural and Livestock Extension Programme
OFSP	: Orange -Fleshed Sweet Potato
PGDP	: Pastoralist Governance Development Programme
SCIDP	: Samburu County Integrated Development Plan
WV	: World Vision

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Sweet potato is one of the world's most important food crop. They are widely cultivated in farms from the tropics to temperate zones of the Far East and United State of America (U.S.A), making it world's number one tuber crop (Smith *et al.*, 2009). It provides more edible energy per hectare compared to wheat, rice, or cassava. The crop requires fewer inputs and less labour than other staple crops. Sweet potatoes can tolerate marginal growing conditions such as dry spells and poor soils (Mohanraj & Sivasankar, 2014). Sweet potatoes are ranked seventh world food crop and is likely to increase in importance in future due to its cultivation by farmers, who are facing chronic food shortage due to unreliable weather and falling purchasing power (Kuehne *et al.*, 2017). The crop has an annual production of more than 100 million metric tons ranking thirteenth globally in production value among agricultural commodities (Truong *et al.*, 2018).

The crop is cultivated primarily for the enlarged edible storage roots which provide high amounts of starch to staple diets which can be eaten either boiled or roasted alone or with other foods such as milk, porridge, soups, or meat and blended with wheat flour to make wheat products (*chapati* and *maadazi*). Sweet potatoes, especially the orange-fleshed varieties, are rich in vitamin A (Scott *et al.*, 2000). According to Mwanga and Ssemakula (2011), about 250 grammes of the Orange Fleshed Sweet Potato (OFSP) can provide the recommended daily requirement for vitamin A. This is particularly important in Sub-Saharan Africa and Asia where Vitamin A deficiency is a leading cause of blindness and premature death among children under five and pregnant women. For instance, in Rwanda, the nutritional values of the OFSP have attracted non-governmental organizations working with people living with HIV and AIDS that urge their clients to grow and consume the tuber (Kimenye & McEwan, 2014; Rajendran *et al.*, 2017). According to Ivers *et al.* (2009), improvement of nutrition can reduce occurrences and severity of infectious diseases with specific action on HIV and AIDS affected families.

In some instances, a relatively strong control women have in decision making in production and marketing has made it being considered as a "women's crop". While this often provides particular opportunities to use sweet potato as an entry point to strengthen nutrition and economic outcomes for women and their children, cultural and gender-defined

roles need to be addressed to improve outcomes at household and community levels (Nungo *et al.*,2007).

The effects of climate change on agricultural systems in developing countries will depend on location and people's adaptive capacity. The Samburu region within Kenya, particularly, remains highly vulnerable to the impact of climate change and has led to some of the farmers adapting agro-pastoralism way of farming. Despite this adaptation, inadequacy of food in Samburu County still stands at 79 percent, while only 2 percent of the population depends on sweet potatoes as source of income. These are mostly found in the Poro areas where farming and livestock activities are practiced (SCDP,2018). Sweet potato production can benefit the agro pastoralists, fight persistent hunger, and improve the source of income if its promotion is enhanced, as drought tolerant crop. Due to rampant animal diseases, persistent drought, harsh climatic conditions, poor soils, inadequate and unreliable rainfall, sweet potato production is considered as an alternative solution to food and nutrition security for pastoralists in Samburu County (SCDP, 2018).

According to Mwanga and Ssemakula (2011) about 250 grammes of the Orange Fleshed Sweet Potato (OFSP) can provide the recommended daily requirement for vitamin A. This is particularly important in Sub-Saharan Africa and Asia where Vitamin A deficiency is a leading cause of blindness and premature death among children under five and pregnant women. For instance, in Rwanda, the nutritional values of the OFSP have attracted non-governmental organizations working with people living with HIV and AIDS that urge their clients to grow and consume the tubers (Rajendran *et al.*, 2017). According to Ivers *et al.* (2009) improvement of nutrition can reduce occurrences and severity of infectious diseases with specific action on HIV and AIDS affected families.

Sweet potatoes can play a very important role in food and nutrition security especially for countries with the sub-Saharan Africa example Kenya. The crop is drought resistant and a relatively short term produce with flexible time of harvest allowing a high degree of flexibility in food availability (Tomlins *et al.*, 2007). Ndolo *et al.* (2012) also stated that rotating sweet potato with maize improves farmers' incomes through higher yields of maize as well as income from sweet potato. However, there is a different perception about sweet potatoes among the communities in Kenya. Sweet potato is considered as a poor man's food mainly used by resource limited households (Scott *et al.*, 2000).

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the farmers adapting agro-pastoralism way of farming. Despite this adaptation, inadequacy of food in Samburu County still stands at 79 percent, while only 2 percent of the population depends on sweet potatoes as source of income. These are mostly found in the Poro areas where farming and livestock activities are practiced (SCDP,2018). Sweet potato production can benefit the agro pastoralists, fight persistent hunger, and improve the source of income if its promotion is enhanced, as drought tolerant crop. Due to rampant animal diseases, persistent drought, harsh climatic conditions, poor soils, inadequate and unreliable rainfall, sweet potato production is considered as an alternative solution to food and nutrition security for pastoralists in Samburu County (SCDP, 2018).

Non-Governmental Organizations (NGOs) play a key role in the socio-economic development of Samburu County (Amina, 2020). Sweet potato farming in Samburu Central Sub-County is mainly supported by World Vision Kenya, an NGO. Sweet potato farming in Samburu Central Sub-County is mainly supported by World Vision Kenya, an NGO. In 2010 World Vision Kenya supported the agro-pastoralist groups with 3000 certified sweet potato vines variety SPK 004 from Kenya Agricultural and Livestock Organization, Katumani Research station in Machakos County. In the year 2011 an additional supply of 4,800 certified sweet potato vines was given to groups in the wards of Samburu Central Sub-County. The households growing beans, sweet potatoes, cassava, and cow peas were 28.6 percent during baseline findings, however, the specific acreage of cassava and sweet potatoes were negligible (SAPLIP,2016). Although agricultural potential land is about 139,000 hectares of the county land is classified as arable land with adequate moisture to support crop farming (Esilaba *et al.*, 2007). Currently only 28,500 hectares of land was being utilized for crop farming (SCDP, 2018). Sweet potato production has been promoted through demonstrations of proper agronomic practices of the crop, but acreage is still less than 0.25 acre per household, as compared to maize, which is 2 acres per agro-pastoralist household.

1.2 Statement of the Problem

Sweet potato a climate smart crop, was introduced by World Vision Kenya in the year 2010 and 2011 in Samburu Central Sub-County due to its ability to yield under adverse climatic and poor soil conditions. The organization distributed 7,800 sweet potato vines to 105 agro-pastoralist households with the expectation that the members were to bulk and share with other agro-pastoralists to grow the vines and ultimately enhance food and nutrition security at household level. However, the production of sweet production was still low with an average of about 0.25 acre. The study sought to determine the perception of agro

pastoralists towards the influence of social, economic factors which has not been documented in Poro ward, Samburu Central Sub-County. The study also assessed the perception of extension agents on factors influencing sweet potato production among the agro pastoralists.

1.3 Purpose of the Study

The purpose of the study was to investigate the perception of agro pastoralists towards influence of social and economic factors on sweet potato production in Poro ward, Samburu Central Sub-County.

1.4 Objectives of the Study

The study was guided by the following objectives:

- i. To determine the perception of agro pastoralists towards influence of social factors on sweet potato production in Poro ward, Samburu Central Sub-County.
- ii. To determine the perception of agro pastoralists towards influence of economic factors on sweet potato production in Poro ward, Samburu Central Sub-County.
- iii. To investigate the perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists in Poro ward, Samburu Central Sub-County.

1.5 Research Questions

- i. What is the perception of agro pastoralists towards influence of social factors on sweet potato production in Poro ward, Samburu Central Sub-County?
- ii. What is the perception of agro pastoralists towards influence of economic factors on sweet potato production in Poro ward, Samburu Central Sub-County?
- iii. What is the perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists in Poro ward, Samburu Central Sub-County?

1.6 Significance of the Study

The Department of Agriculture, Livestock and Fisheries at the county government of Samburu and other County institutions with similar characteristics may use the findings from this study to enhance sweet potato production. For the scholars in other institutions who may be interested in pursuing knowledge in related areas, the study could provide insights and

guidelines on the factors that influence sweet potato production amongst agro pastoralists. The researchers can use the study as a basis for further research in commercialization of sweet potato. The findings may inform policy makers on reinforcement for production of drought tolerant crops, especially sweet potato to ensure food and nutrition security improvement, especially in arid and semi-arid areas. Sweet potato can adapt well to diverse climatic conditions, survive long dry spells, and can be harvested and stored on a flexible time schedule.

1.7 Scope of the Study

The study was confined to agro-pastoralist groups who were given sweet potato vines by World Vision Kenya organization in Samburu Central Sub-County. The study was carried out with a total of 99 agro-pastoralists from Poro ward. Five extension officers were also selected as key informants. Data collected was limited to perception of agro pastoralists towards influence of social, economic factors and extension agents on sweet potato production in Poro ward, Samburu Central Sub-County, where other factors such as climatic conditions were left out.

1.8 Assumptions of the Study

- i. The study used researcher administered questionnaires and assumed the information given by the respondents was accurate.
- ii. The households under study have access to sweet-potato vines and extension officers.
- iii. The knowledge on sweet potato was evenly disseminated in Poro ward.

1.9 Limitation of the Study

The chosen geographical and physical locations of the agro-pastoralists limit the generalizability of findings to Poro ward of Samburu County.

1.10 Definitions of Terms

Adoption: Refers to a decision to continue full-scale use of an innovation (Rogers,2010) In this research, it refers to the number of people growing sweet potato.

Agricultural Extension: This is the application of scientific research and knowledge to agricultural practices through farmer education (Kuehne *et al.*, 2017). Generally, it can be defined as the “delivery of information, inputs to farmers. In the study, it is a service provided by extension agents to agro-pastoralists.

Agro-pastoralists: This is the integration of crop and livestock production, and is practiced amongst settled, nomadic, and transhumant communities (Sanz *et al.*, 2017). In the study, they are community members in Poro ward, who keep livestock as well as growing crops such as sweet potatoes and other crops.

Bulking: In volumes, size, magnitude or relatively large in members (Liu *et al.*, 2019). In the study it is growing of sweet potato vines in large volumes, size, and magnitude or relatively large in numbers to share with other agro-pastoralists.

Cultural factors: They refers to “deeper” descriptors of common attitudes or thought patterns characteristic of cultures for agro-pastoralists than are captured by the overt, “shallow” and potentially rote nature of our politeness behaviors (Miller *et al.*, 2011). In the study, it is the attitudes of agro-pastoralists on sweet potato production.

Economic factors: They are issues that affect crop farming and includes interest rates, tax rates, policies, wages or salaries (incomes), and even governmental activities (Ameh & Andrew, 2017). However, for the purpose of this study, it refers to the sources of income for the agro-pastoralists of Poro ward.

Extension staff: A group of country extension staff appointed to give greater emphasis to intensive work with farm families (Chandler, 2004). In the study, the extension agents in Samburu County are staff, employed to provide useful information to agro-pastoralists and pastoralists.

Influence: This is the capacity to have an effect on the character, development, or behavior of someone or something, or the effect itself (Epton *et al.*, 2017). In this study, it is used to show the contribution or the role of one factor or characteristic on a particular outcome, for example sweet potato production.

Innovation: This is the core action for the development and productivity of any economic activity (Timu & Antanas, 2017). In the study it is the actual action of cultivating sweet potato by agro-pastoralists.

Perception: This is the way humans interpret their experiences; it is a way of seeing and understanding (Otara, 2011). In this study it will be a cognitive process that enables agro pastoralists and extension staff to interpret and understand their surroundings in relation to sweet potato production.

Socio-cultural factors: They are larger scale forces within cultures and societies that affect the thoughts, feelings and behaviors (Włodarczyk-Marciniak *et al.*, 2020). They can be defined as the customs, lifestyles and values that characterize a particular society. In this study, such factors include the shared values, norms, and attitudes of the agro-pastoralists of Poro ward towards sweet potato production.

Social factors: They are general factors at the level of human society concerned with social structure and social processes that impinge on the individual (Stansfeld & Rasul, 2006). In the study, they are factors that affect thoughts and behaviours of agro pastoralists in social situations in Poro ward.

Sweet Potato Production: This is the process of growing sweet potato crops for use as food for humans and fodder for Livestock (Truong *et al.*, 2018). In the study, sweet potato production referred to acreage, duration and bulking of sweet potatoes for other agro pastoralists.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature review on previous research work done in the field of agriculture and more specifically about sweet potato farming and factors influencing production of the crop in the study. The topics covered in the chapter are perception of agro-pastoralists on sweet potato production, influence of social and economic factors on sweet potato production, as well as influence of extension staff on sweet potato production, theoretical framework, and conceptual framework of the study.

2.2 Agro-pastoralists and Sweet Potato Production

Agricultural technologies have not been uniformly accepted by farmers across many regions of the world. Nyariki *et al.* (2009) revealed that agro-pastoral land use systems are on the increase. Although results from the research areas shown that farmers are reluctant to cultivate sweet potato instead of other crops. This might be attributed to the results of Jena *et al.* (2012) which stated that farmers allocate their few resources to produce the traditional cereal crops such as teff, maize, barley, and wheat. These crops fetch good prices in the market because of their high demand. This is important because of the high poverty rate among subsistence small-scale farmers in Ethiopia.

According to Aldow (2017) local people culturally prefer to eat cereal crops rather than sweet potato. Moreover, the government assigns more money, and research, to increase cereal crop and cash crop production. It appears the government is not aware of the benefits of the sweet potato to farmers' diets, and as a food security crop. Therefore, the government is unwilling to encourage farmers to plant the crop. Belehu *et al.* (2004) and Kivuva *et al.* (2014) stated that Ethiopia's average sweet potato storage yield is low with 8 t/ha, although the potential yield is 30 - 73 t/ha. In Samburu County, the area of landscape being cultivated by agro-pastoralists is slowly increasing in many areas and they have started diversifying their livelihood options to produce either homegrown food or cash crops (Hakizimana *et al.*, 2017).

The slow pace of adoption is attributed to Samburu men being proud pastoralist warriors, who own cattle, whose life revolves round cattle and always disliked tilling, akin to famous Maasai (Oywaya-Nkurumwa *et al.*, 2011; Karanja *et al.*, 2016). Following a study by Zawedde *et al.* (2014) loss of planting materials due to drought was a major constraint to maintaining varietal diversity for this vegetative propagated crop. Limited land and lack of

access to best management practices were also key constraints to maintenances of farmers' varieties. However, increased conversion of predominantly grazing land to commercial cultivation has led to competition for land resource between livestock and crops. The remaining land is increasingly privatized through subdivision and allocation of rights for grazing and farming enterprises. According to Magembe *et al.* (2013) land is a resource that facilitates agricultural activities. In a study that sought to evaluate the factors associated with shift from pastoral to agro-pastoral farming systems in Trans-Mara West Sub-County of Narok County Kenya. They also found that declining land sizes increased the shift to agro-pastoral farming by 0.8 percent. This may imply that farmers with less land sizes could shift to agro-pastoral farming as compared to those with more land sizes. Magambe *et al.* (2013) further found that land ownership with title deeds showed up as positive and significant, along with household size. So, larger household sizes together with land title deeds could determine the proportion of land allocated to production.

A study by Rana *et al.*(2007) found that private land ownership with title deeds gives farmers a right to use the land. This creates an incentive for the farmers to make necessary investments in their land which are long term. However, negligible percent of the populations in the Samburu County possess the title deeds (Karanja *et al.*,2016). This indicates that majority of land is communally owned under the group ranches, where pastoralism and agro pastoralism are being practiced. This limits access to loans and other investment opportunities which are guarantee by title deeds (SCDIP, 2018). Diale (2011) in his study found that access to farm land was one of the factors that influenced adoption of hybrid sorghum cultivars in South Africa. Mazuze (2004) on the other hand, found farm land size had an influence on sweet potato farming in Mozambique. Kirwa *et al.* (2012), in a study that sought to characterize the existing adaptive strategies and shifts in smallholder agro-pastoralists in relation to changes in land use and land subdivisions, found 20.5 percent of the respondents were of the view that better access to land was one of the factors that led to shifts by smallholder agro-pastoralists.

Kivuva *et al.*(2014; Kidane *et al.* (2013) ; Low *et al.* (2007) indicated that, Orange-Fleshed sweet potato is a good source of vitamin A, which can tackle vitamin A deficiency among children. These benefits can classify sweet potato as a food and nutritional security crop. According to Gurmu *et al.* (2015) and Belehu (2004) sweet potato also is as a healthy diet for millions of people across the country and cultivated as an integrated crop, along with livestock, in the crop–livestock farming systems. Krochmal-Marczak *et al.* (2013) revealed that, the value of sweet potato leaf as containing protein and crude fiber which are

important for addressing deficiency diseases and colon diseases. The study further found that both sweet potato tuber and leaf contain micronutrients necessary for healthy body. Existing studies on sweet potato production have mainly focused on examining nutritional value, marketing constraints or concentrated in developed countries such as Asia and Pacific (Ezin *et al.*, 2018; Zhang *et al.*, 2017).

Sweet potato, the edible root tubers are chipped, dried, and milled into flour. It is then used to prepare snacks and special recipes for weaning young babies. OFSP varieties not only contain high calorific value but are also rich in proteins and minerals (calcium, iron, riboflavin, and thiamine). They also contain high levels of β -carotene, which is a precursor for Vitamin A (Kidmose *et al.*, 2007). Its starch has properties that are useful in many food products and manufacturing processes (Mitra, 2012). For this reason, it is used to produce industries starch, natural colorants, fermented products, ethanol, lactic acid, acetone, and butanol.

Drought tolerant crops like sweet potato are preferred as an alternative solution to food and nutrition security for pastoralists in Samburu County as a result of persistent drought, harsh climatic conditions poor soils, inadequate and unreliable rainfall (Karanja *et al.*, 2016). Majority of the pastoralists/agro-pastoralists have been consuming one meal consisting of cereals and oil (*lkitegek*) compared to normal 3 meals consisting of all nutritional requirements, although they dependent mainly on livestock for their livelihood. This might have contributed to majority of population lacking access to adequate food, proportion of children been at risk to malnutrition (Juma *et al.*, 2017). The willingness of government to support roots and tubers farming, which aims at improving contributions of the crops to food and nutrition security as an alternative to staple food in the country is therefore indispensable (Hagenimana *et al.*, 2001). This study seeks to investigate factors influencing sweet potato production amongst agro-pastoralists, which have contributed to low production of the crop in Samburu Central Sub-County.

2.3 Influence of Social Factors on Sweet Potato Production

According to Vanclay (2004) adoption of practices that take place in a social context such as farming is not a technical activity, but a social-cultural practice, which becomes a way of life. Traditional beliefs, negative attitudes towards production, strong cultural systems, harsh climatic conditions, and the worsening insecurity have largely contributed to low levels of community development, especially sweet potato production in insecure zones, which are agriculturally potential areas (SAPLIP, 2016). Despite the benefits associated with crop production, access to communal land for production purposes among the pastoralists community is based on complex social, cultural, and historical norms and conditions that historically have maintained flexible access to resources across space and time (Boone *et al.*, 2005).

Social factors, such as population growth, continue to expand and put pressure on the farming land leaving the soil with no time to recover (Funk *et al.*, 2008). Thus, all these factors reduce the sweet potato storage root yield production (Kivuva *et al.*, 2014). Empirical studies that have attempted to test the relationship of key variables to adoption behavior among farmers from different socio-economic background have yielded mixed results. Kiiza *et al.* (2012) identified and categorized that, factors influencing adoption of new agricultural technologies into farm and farmer associated attributes, technology associated attributes and the farming objective. Studies have shown that the prevailing socio-cultural practices have the power to influence adoption of agricultural technology. Atkin (2013) added that low-income consumers in the developing world were willing to trade off substantial caloric intake for preferred foods. The study also revealed that preferences and specifically perceived profitability are also shaped by social context and norms around food and agriculture may guide aggregate adoption patterns.

Magembe *et al.* (2013) reported that influence from the neighborhood significantly and negatively affected the extent of shift from pastoral to agro-pastoral farming systems. The study revealed that as farmers interacted more with their neighbours, the probability of allocating more land for crop production declined by 12.7 percent. So, depending on who forms the neighborhood, farmers could decide to allocate more or less land towards sweet potato production. Langyintuo and Mekuria (2005) argued that as farmers interact more with their neighbours and outside world, they become more able to assess the relevance of new technologies and ideas thus they exercise a choice.

Munshi and Rosenzweig (2006) revealed that social norms are relevant for technologies where individual adoption decisions generate costs and benefits from both the profitability of

the technology and the possibility of social sanction. Diale (2011) and Mazuze (2004) also agreed cultural influences are factors that affect adoption of technology. Livestock is tightly intertwined in the Maasai economy and social structure, religion and relationships; which is almost similar with the Samburu pastoralists (Oywaya-Nkurumwa *et al.*, 2011). Bandiera and Rasul (2006) used a random sample of household heads from several villages in Mozambique found that kinship is very significant to adoption of new technology. They also revealed that herding effects may be more complex than once thought.

Magembe *et al.* (2013) in a study that, compared the socio-economic factors associated with shift from pastoral to agro-pastoral farming systems in Trans-Mara West Sub-County found that some households shifted to agro-pastoralism out of necessity, whereas others shifted by choice. For some of the households, the shift was a means to reduce risk, while for others it reflected changing cultural, dietary habits and social norms. In a cross-sectional study conducted in Shinyanga rural and Mwanza urban, Tanzania to establish the social economic factors affecting consumption of sweet potato.

Mmasa and Mlambiti (2015) revealed that the potential of the crop is barred by negative perception as female crop, because it does not command a place over maize or cotton in the market. As result many women use it for household food security when maize harvests fail. Such perception may have a negative influence in sweet potato production. However, if the adoption of production of sweet potato will have negative consequences on the agro-pastoralists in Samburu and even interfere with their traditional practices, then there is the likelihood that adoption of the innovation (sweet potato production) may not be adopted. Samburu County Government was planning to promote drought resistant food crops example sorghum, sweet potatoes, cow peas, maize, green grams, and local vegetables through capacity building of community members on adoption of crop production, especially sweet potato as alternative livelihood to pastoralism (Brunstrom *et al.*, 2014 & SCDIP, 2018). The study needs to find out the influence of traditional beliefs, negative attitudes towards sweet potato production.

2.4 Influence of Economic Factors on Sweet Potato Production

According to Langyintuo and Mekuria (2005) argued that as farmers interact more with their neighbours and outside world, they become more able to assess the relevance of new technologies and ideas thus they exercise a choice. Many studies have indicated that broad-based agricultural development provides an effective means for both reducing poverty and accelerating economic growth (Thomas *et al.*, 2010).

Sweet potato can play a very important role in food and nutrition security strategy for Kenya since it is drought resistant, it is a relatively short term crop with flexible time of harvest allowing a high degree of flexibility in food availability and finally it improves the yield of maize in a crop rotation compared to continuous maize production (Tomlins *et al.*, 2007). Research has shown that rotating sweet potato with maize improves farmers' incomes through higher yields of maize as well as income from sweet potato (Ndolo *et al.*, 2001). Processing and utilization of sweet potato has the potential to enhance the production of the crop and can play important place in income generation, food and nutrition security and among the rural households and even urban markets (Tomlins *et al.*, 2007). According to Fonseca (2003) International Potato Center in Lima, Peru has launched a major project to leverage the untapped potential of sweet potato to significantly improve the nutrition, incomes, and food production of farming families in Sub-Saharan Africa, especially among impoverished women and children

Allemann *et al.* (2004) in their study found that sweet potato was of considerable economic value in South Africa with marketing chains well-organized for local and export markets. These findings may imply that with economic gains in mind, the locals in Samburu County may decide to adopt sweet potato farming as a way of increasing their financial income. Mazuze (2004) examined the factors that affected the adoption of orange-fleshed sweet potato in Gaza Province, in Mozambique and found that the adoption was mostly dependent on the farmers' socio-economic conditions. Diale (2011) in a different study sought to establish the socio-economic factors that influence adoption of hybrid sorghum cultivars in Makhuduthamaga Municipality in Sekhukhune District, Limpopo Province in South Africa found that farm income was one of the major factors that influenced adoption of hybrid sorghum cultivars.

Achoja and Uzokwe (2012) conducted a study that used descriptive statistics and Pearson correlation analysis to investigate the income effect and correlating factors of yam miniset technology among farmers in Delta State, Nigeria using data from selected 81 yam farmers. The researchers found that yam miniset production contributed significantly to the income of yam farmers. Their results showed that farm size, educational status and age of respondents had significant and positive relationship with income effect. Orinda (2013) stated that group membership positively contributes to the extent of value addition, and this can be explained by the fact that individuals in groups are easily influenced by their associates than those in isolation. This can be attributed to the fact that farmers in groups get to exchange ideas and influence each other leading to adoption of value addition techniques. Group

membership ensures collective production, marketing, training ensuring pooling of resources together and reduction of information asymmetry thus reducing transaction costs and ensuring economies of scale.

Utilization of sweet potato-based confectionary was used as a step to reducing food crisis among women farmers in Imo state Nigeria because of the health benefits, environmental friendliness and ability to make a home food secured with little investments (Amamgbo *et al.*, 2011). According to Mwololo *et al.* (2012) sweet potato is also an important food, feed and cash crop in Eastern Africa but its adoption as a dual purpose crop has not been exploited The untapped potential of the crop benefits might be due to economic limitations, which include poverty, poor market, lack of transport infrastructure, as well as lack of government investment in agriculture, research, and policies that help local production. Current agricultural policies are not in favor of supporting small-scale farmers (Amjath-Babu *et al.*, 2016).

Lynn (2010) showed that cultivation for profits for Maasai in Simanjiro were largely positive, raising some below-subsistence pastoralists above the subsistence threshold and others toward it. The study found that resilience is increased as a product of both intermittent food production and a quick potential food following drought, while livestock populations recover. Cultivation success was correlated with herd wealth in two villages, but data from a third village showed widespread crop failures across the entire wealth gradient, which could be due to rainfall failure or off-farm income. Spearhead campaigns on adoption of Agriculture as alternative livelihood to pastoralism through diversification of drought resistant food crops for instance sweet potatoes will enhance food security and provide extra income to agro-pastoralists in Samburu County (SCDP, 2018). This study seeks to find out the economic factors influencing sweet potato production.

2.5 Influence of Extension Staff on Sweet Potato Production

The role of agricultural extension services in the development of agriculture throughout the world is not in doubt. It has remained one of the prime movers in the development of agriculture and invariably in rural development. Davis (2008) said extension services play a key role in providing information and promoting new technologies or new ways of managing crops and farms. Thus, extension service staff can introduce locally appropriate technologies and management techniques that enable farmers to adapt to new farming techniques. The extension services can be through results demonstrations, where two technologies are compared and method demonstrations, which are done to enhance a specific relevant technology required by participants, through model plots and group meetings. These are more effective in terms of time and services provided as compared to individual farm visits (Ali-Olubandwa *et al.*, 2010).

Extension service is to reduce the farm inputs, while increasing the productivity in a sustainable manner (Swanson, 2008). Rogers (2010) looked at the process of adoption as a mental process that an individual passes through, before adopting or rejecting an innovation. Individual preferences around product attributes, including taste and cultivation practices, will affect how the product is perceived by the household. This is particularly true of production for home consumption. According to Oywaya-Nkurumwa *et al.* (2011) extension personnel provide modern scientific methods of farming and keep farmers updated on new research development that is relevant to them. Extension services facilitate pastoralists to integrate livestock keeping and farming activities by providing vital information, such as new crop varieties, for instances orange-fleshed sweet potato, proper agronomic practices, marketing, and crop prices. The extension methods ensure farmers share experiences and influence adoption of new innovation, such as sweet potato production. Magembe *et al.* (2013) in a study that sought to evaluate the factors associated with shift from pastoral to agro-pastoral farming systems found that 80 percent of the observed variation in the extent of the shift from pastoralism to agro-pastoralism could be explained by the number of contacts with extension services. Extension staff role is sharing knowledge, technologies and agricultural information and linking farmers to actors in the economy. This will facilitate transformation of subsistence farming to modern and commercial agriculture, hence enhancement of household food security and reduction of poverty (De Janvry & Sadoulet, 2011).

Doss (2003) revealed that the major reasons for technology non-adoption were due to farmer's unawareness of the improved technologies or a lack of information regarding

potential benefits accruing from them; the unavailability of improved technologies; and unprofitable technologies, given the farmer's agro ecological conditions and the complex set of constraints faced by farmers in allocating land and labor resources across farm and off-farm activities. However, Onemolease and Alakpa (2009) revealed that farmers in contact with extension agents are two times more likely to increase adoption of crop-related innovations than those with no contact. Amjath-Babu *et al.* (2016) stated that some of the crop production challenges are inadequate extension services at all levels, lack of modern farming methods, post harvesting losses and high dependence on relief food.

Kiiza *et al.* (2012) analyzed the impact of participatory plant breeding and participatory variety selection on the adoption of improved sweet potato varieties in Central Uganda. The study quantitatively assessed how the two approaches influence farmers' uptake of the improved sweet potato varieties and determined other factors influencing this production. Findings revealed that both participatory plant breeding and participatory variety selection positively and significantly influenced the likelihood of adoption of improved sweet potato varieties at 5 percent and 10 percent levels. Magembe *et al.* (2013) in a study that, compared the socio-economic factors associated with shift from pastoral to agro-pastoral farming systems found that better access to credit facilities and extension services enhanced the shift among the agro-pastoralists. This may imply that the presence of extension agents could influence sweet potato farming amongst the agro-pastoralists. Muyanga and Jayne (2008) stated also that extension activities were intended to increase the ability of farmers to optimize the use of their resources and ultimately increase crop yields. It also expected to act as a link between farmers and the research organizations by ensuring feedback from farmers to research stations.

Diale (2011) in a study that sought to establish the socio-economic factors that influenced adoption of hybrid sorghum cultivars in Makhuduthamaga Municipality in Sekhukhune District of Limpopo Province in South Africa found that access to extension service, membership to agricultural co-operatives, access to credit and inputs influenced production. Mazuze (2004) also found that adoption of orange-fleshed sweet potato in Mozambique was affected by availability of extension services, productivity, and availability of new technology. These findings affirm the important role played by agricultural extension services in adoption of new technology. Nkurumwa *et al.* (2010) found that, the attitude of Maasai towards change is negative due to conservative nature of their culture and low level of interaction with outsiders. Maasai are pastoralists and they generally believe what was taught by their older men were the right things, while distrusting unfamiliar issues from

outside World. This study seeks to find out the influence of extension services on sweet potato farming amongst the agro-pastoralists.

2.6 Theoretical Framework

This study was guided by Diffusion of Innovation Theory (Rogers, 2010). The theory points out that the degree to which innovation is desirable or undesirable ultimately depends on how the innovation is taken by the members of the system. It shows that there must be something new such as sweet potato production which is spread through communication channels to a particular society. According to the determination of whether an innovation will be adopted depends on the effects of its consequences on the adopters. In this study, the adoption of sweet potato production by the agro-pastoralists in Samburu County was expected to largely depend on social and economic factors. Thus, if cultivating sweet potato will benefit the agro-pastoralists in fighting persistent hunger and improve the source of income, while resulting to food security and poverty reduction, then enhancement of production will be the way to go. This may improve the living standards of the agro-pastoralists. Furthermore, sweet potato production will also depend on how the innovation interacts with the Samburu culture. This is supported by Oywaya-Nkurumwa *et al.* (2011) who stated that livestock is tightly intertwined in the Maasai economy and social structure, religion, and relationships, which is almost similar with the Samburu pastoralists. However, if the adoption of production of sweet potato will have negative consequences on agro-pastoralists in Samburu and even interfere with their traditional practices, then there is the likelihood that adoption of the innovation, sweet potato production may not be realized.

2.7 Conceptual Framework

In the context of Diffusion of Innovation theoretical background, it is of concern to indicate influence of social and economic factors on sweet potato production among agro-pastoralists. The conceptual framework shows relationship among the study variables as illustrated in Figure 1. The independent variables are on left, which consists of social factors and economic factors. While on the right is dependent variable, which entails acreage of sweet potato, duration of growing sweet potatoes, production and bulking of sweet potato for other farmers. The moderating variables are hypothetical internal states used to describe link between variables. In this study they comprise education level and age.

**Independent variable
variable**

Dependent

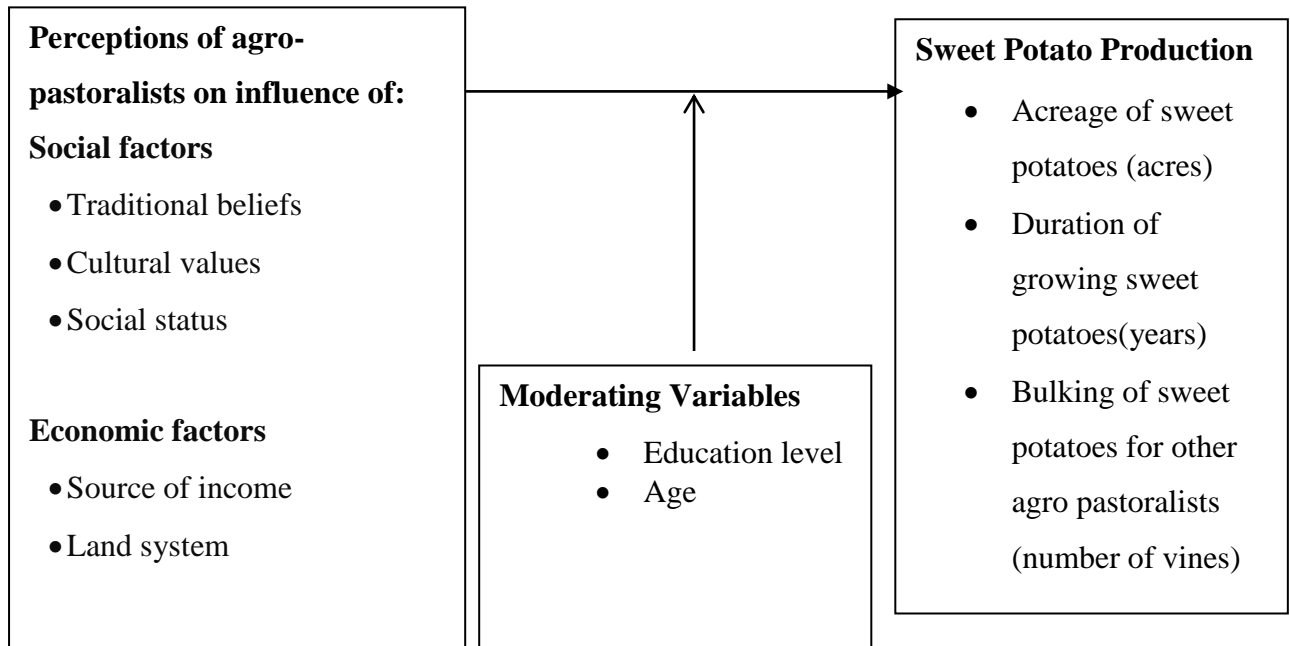


Figure 1. *Illustration of Linkage among the Variables in Sweet Potato Production*

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and procedures which were used to carry out the study. It gives an overview of the research design, study location, the population of study, sampling procedures and sample size, instrumentation, validity, reliability, data collection procedures and data analysis.

3.2 Research Design

The study adopted a descriptive survey research design. This design is appropriate in collecting information about people's attitudes, opinions, habits or any of the variety of education or social issues (Mugenda & Mugenda, 1999). As such, this research study used a survey method to collect both quantitative and qualitative information. This gave more insights to the investigation being carried out as well as provided statistical support to this study on perception of agro pastoralists towards influence of social, economic factors and extension agents on sweet potato production in Poro ward, Samburu Central Sub-County. This design was considered appropriate in this study as it provided ground information.

3.3 Location of the Study

The study was done in Samburu County, which lies within the Arid and Semi-Arid parts of Kenya and has an area of 21,022.1 sq. Km. It is situated in the Northern part of the Great Rift Valley. Samburu is bordered by Turkana to the Northwest, Baringo to the Southwest, Marsabit to the Northeast, Isiolo to the East and Laikipia to the South. The County lies between latitudes 0°30' and 2° 45' North of the equator between longitudes 36°15' and 38° 10' East of the Prime Meridian (SCIDP, 2018). Samburu Central Sub-County is located to the South of Samburu North Sub-County, to the West of Samburu East Sub-County, to the Northeast of Baringo County and to the North of Laikipia County as illustrated in Appendix IV. The estimated population is 105,052 with a total of 22,820 households in Samburu Central Sub-County during 2019 National Population Census (KNBS, 2019). The land tenure is mainly communal with 5 percent of the population having title deeds SCIDP (2018).

The Samburu Central Sub-County is divided into four agro-ecological zones as follows: Lower Highlands (L H 2-3), Lower Highlands (LH 4-5), Upper Midlands (UM 4-7) and Lower Midlands (LM 6-7). Rainfall in the county follows an erratic pattern varying significantly both in temporal and spatial scale. The county experiences both short and long rains. The driest months are January and February. The long rainy season falls in the months of March, April and May, while short rainy season usually delays and occurs in October and November and sometimes extends into December. Rain distribution varies across the County. The central basin and the plain East of the Matthews Range are the driest parts of the County with annual rainfall of between 250 mm and 500 mm. The southwest plains and Lorroki Plateau receive between 500 mm and 700 mm of rain annually. The Nyiro and Ndoti Mountains and Matthews range, however, receive the highest amount of rainfall between 750 mm and 1250 mm per annum.

Temperatures in the County vary with altitude and mean temperatures generally range between 24°C and 33°C. The Central plains and the region East of the Matthews Range have the highest temperatures, while the highland belts in the Northeastern side of Lorroki Plateau is cooler. The County has a mean temperature of 29°C. According to SCIDP (2018) out of 139,000 hectares of arable land in Samburu Central Sub-County, only 28,500 hectares is under crop production. On average, the acreage of sweet potato grown by the agro pastoralists is 0.25 acre, which is low compared to that of other crops.

3.4 Population of the Study

The target population was all agro pastoralists in Poro ward in Samburu Central Sub-County. The accessible population were farmers who were given sweet potato vines by World Vision organization. The sampling frame of 105 agro pastoralists who benefitted from sweet potato vines was obtained from Department of Agriculture in Samburu Central Sub-County and involved. The 105 agro pastoralists were from five farmers groups in Poro ward.

3.5 Sampling Procedure and Sample Size

According to Kathuri and Pals (1993) for a population of 140 the appropriate sample size is 103. In this study with a population of 105 agro-pastoralists the sample size was calculated using the formula (Krejcie & Morgan, 1970) as shown below;

$$n = \frac{X^2 * N * P * (1-P)}{(ME^2 * (N-1)) + (X^2 * P * (1-P))}$$

Where:

n= sample size

χ^2 = Chi-square for the specific confidence level at 1 degree of freedom (1.96)

N= Population size (105)

P= Population proportion (0.5)

ME= Margin of error (5%)

The sample size according to the above formula is 100.

Purposive sampling was used to select the five groups that received sweet potato vines. Proportion allocation was used to determine the number of respondents to be sampled in each group. Then simple random sampling was carried out to select respondents from each group. The sampling procedure is shown in Table 1. Census was used to select the 5 agricultural extension agents as key informants, who were the trainers of agro-pastoralists on agronomic traits of sweet potato. Then, eight members of Focus group of agro-pastoralists leaders were purposively selected.

Table 1

Sampling Procedure for the Agro-pastoralists

Sample Groups	Population size	Proportion	Sample Size
Namaiyan youth group	27	0.26	26
Wangan Lam women group	24	0.23	23
Namaiyan Women Group	20	0.19	19
Nkatiriman women group	20	0.19	19
Loriani self-help group	14	0.13	13
Total	105	1.0	100

Source: Department of Agriculture republic of Kenya (2013)

3.6 Instrumentation

The instrument used for this study was a questionnaire of two types, one containing close ended questions (Appendix 1) which was administered by the researcher to the agro-pastoralists and the other having semi-structured questions (Appendix 2) which was self-administered to the extension agents. A questionnaire was considered appropriate due to its cost effectiveness and ensured a wider reach of respondents. The agro pastoralists were guided to ensure elaboration of questions and clarification of answers due to their low level

of education. The self-administered questionnaire was used for extension agents due to their ability to read, interpret and respond to the research questions. In this regard, researcher administered questionnaire was subdivided into three parts; subsection A of the tool gathered general information on agro pastoralists; subsection B on production of sweet potato; and subsection C collected data on the factors relating to sweet potato production such as acreage, duration and bulking of the vines under sweet potatoes, social factors economic factors, and extension services offered. The self-administered questionnaire was subdivided into two parts; subsection (A) collected data on the extension agent's general information, while subsection B got data on perception of extension agents towards factors influencing sweet potato production amongst agro pastoralists. The study also included a guide for Focus Group Discussion (Appendix 3).

3.6.1 Validity

Validity is the extent to which the instrument measures what it is purposed to measure according to the subjective assessment. The validity of the instrument is asking the right questions from the least ambiguous way (Mugenda & Mugenda, 1999). Both construct and content validity were addressed so as to measure the degree to which the instrument meaningfully and accurately represents a concept to be considered (Kimberlin & Winterstein, 2008 ; Gibney & Wiersma, 1986). In the validation of the instruments, the experts in department of Applied Community Development Studies, Egerton University were consulted to determine their clarity, relevance, and adequacy. Their suggestions were used to make necessary adjustments and improvement of the instruments before data collection.

3.6.2 Reliability

Reliability indicates the extent to which other researchers would arrive at similar results if they studied the same case using the similar procedures as the first researcher (Bush, 2012). To ensure consistency, the instruments of the study were pilot tested in Lodokejek ward in Samburu Central Sub-County before preparation of the final instruments. This was important to ascertain reliability and uncover any deficiencies in the instruments that may not have been apparent by simply observing the items (Golafshani, 2015). The questionnaires were piloted on 15 agro-pastoralists household heads in Lodokejek ward. The number of subjects used in pilot testing was determined from the guidelines given by Kathuri and Pals (1993) who stated that the sample size for pilot-tests should be about 10-15% of the sampled population. The researcher computed Cronbach's alpha coefficient where the variable with an

alpha value of 0.746 was considered reliable. The analysis of pilot test results enabled the researcher to make appropriate changes to various items, resulting in the improvement of the instruments. The items which were ambiguous were corrected. All the items included in the questionnaire had the Cronbach Alpha value of 0.746 According to Reynaldo (1999) Cronbach Alpha values of between 0.7 or there about and 1 indicate ideal levels of internal consistency and as a result the instrument was found to have the ability of collecting reliable data for analysis.

3.7 Data Collection Procedure

A letter was obtained from Graduate School, Egerton University, which facilitated application for a permit from National Commission for Science, Technology, and Innovation (NACOSTI) to conduct the research. Clearance was obtained from the Samburu County Commissioner, directors of Departments of Agriculture and Education before undertaking the study, which guaranteed cooperation of extension personnel and the agro pastoralists during the study. The data was collected from agro pastoralists through asking them the questions in the questionnaire and duly filling the questionnaire. For the extension officers, they were handed their questionnaires and filled on their own.

3.8 Data Analysis

The computer based for Statistical Package for Social Sciences (SPSS) version 25 was used to aid in data analysis. The independent variables were social factors, economic factors, and perception of extension agents. Descriptive statistics, such as percentages and frequency distributions were used to summarize the respondents' biodata, the level of acreage, duration and bulking of the vines under sweet potato production. The social factors, economic factors and extension services offered on sweet potato production were also included, as shown in Table 2.

Table 2*Summary of Data Analysis*

Research questions	Independent variables	Dependent variable	Statistical tool for analysis
What is the perception of agro pastoralists towards influence of social factors on sweet potato production?	Influence of Social Factors	Sweet potato Production	Descriptive statistics (percentages, frequencies)
What is the perception of agro pastoralists towards influence of economic factors on sweet potato production?	Influence of Economic Factors	Sweet potato Production	Descriptive statistics (percentages, frequencies)
What is the perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists in Poro ward, Samburu Central Sub-County?	Influence of Extension agents	Sweet potato Production	Descriptive statistics (percentages, frequencies)

3.9 Ethical Issues in Research

The researcher introduced herself to the participants and briefed them on the purpose of the research as academic, intended to generate scientific knowledge on the community. She also informed them that their participation was voluntary. The informed consent was obtained from all participants before the interviews. The dignity and wellbeing of participants was always protected. The research data remained confidential throughout the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents the findings of the study and the discussions, which were analyzed to reflect the three objectives of the study. The first section deals with biographic data of the agro-pastoralists. The second section describes social and economic factors that influence the sweet potato production by agro-pastoralists. The third section presents perception of agro-pastoralists on extension agents on sweet potato production. The findings of Focus Group Discussions (FGDs) done are presented as provided by local leaders of the community. The information by Key Informants is also included.

4.2 Demographic Characteristics of the Respondents

A total of 100 respondents were sampled for the study, and 99 responded. The response rate was 99 percent, which is acceptable, as it meets the minimum response rate of 60 percent as stated by Kathur and Pals (1993). Bio-graphic characteristics such as age, gender, level of education and access to capital and labour markets, land tenure security, social capital are important factors in farm technology adoption decisions (Mwabu *et al.*, 2006). The respondents' demographics investigated in this study were gender, age and level of education as illustrated in Table 3.

Table 3

Demographic Characteristics of Respondents

Demographic group	Category	Percentage
Gender	Male	8
	Female	92
Age	18-28	7
	29-39	37
	40-50	42
	51-61	10
	62 and above	4
Level of Education	No education	63
	Primary	26
	Secondary	8

	Tertiary	4
Marital Status	Married	82
	Separated	2
	Widowed	9
	Single	7
Family size	Below 5	10
	5-10	74
	11-15	16

Most of the respondents were female at 92 percent, which was likely due to the cultural practices of the agro-pastoralists in the county, that give women more farm activities than men. The results reflect the concept by Karanja *et al.* (2016) that Samburu men are proud pastoralist warriors, who own cattle, while their lives revolve round cattle and always disliked tilling of land, akin to famous Maasai. The organization was also working with formal groups, where women have formalized their groups compared to men. The age range of 40-50 years was common for majority of respondents at 42 percent, which implied that middle-aged respondents practiced farming more, followed closely by 29-39, who are considered energetic group for farm activities at 37 percent.

On level of education majority of respondents at 62.6 percent had no education. According to Graamans *et al.* (2018) girls who have undergone Female Genital Mutilation (FGM) were mostly married off early thus denying them an opportunity to attend school. *Moranism* is also practiced in the county and young boys are taken for training for some period in keeping with the traditions, which denies them time to attend formal education. Nzomo and Nzongang (2007) observed that highly educated farmers tend to adopt technology with greater intensity implying the low education of the respondents could influence adoption of sweet potato production. Most of the respondents who were married off stood at 82 percent, while the family size with a range of 5-10 persons was at 73.70 percent. The findings indicated a relatively large family size hence availability of labour force at the household level for sweet potato production, but also more mouths to feed.

4.3 Sweet Potato Production among the Agro-Pastoralists

Production of sweet potato was considered in terms of acreage of sweet potatoes in acres and duration of production in years, bulking and sharing of sweet potato vines with other agro pastoralists was also included with respect to number of vines distributed.

4.3.1 Organizations and Years Respondents were given Sweet Potato Vines.

The organizations and years the respondents were given sweet potato vines are indicated in table 4.

Table 4

Organizations and Years the Respondents Received Sweet Potato Vines

Organizations	Varieties	Years	Percent
World Vision	SPK004	2010/2011	91.9
Other organizations	Unspecified		8.1
Total			100

The findings indicated that 91.9 percent of the respondents were given variety SPK 004 of sweet potato vines in the years 2010 and 2011 by World Vision, while other unspecified organizations gave other varieties to 8.1 percent of respondents. The initial objective of World Vision was to facilitate agro pastoralists to enhance food and nutrition security through production of sweet potatoes at household level. The surplus of sweet potato tubers was to fetch extra income for the agro pastoralists. In 2010 and 2011 World Vision Kenya 7800 certified sweet potato vines variety SPK 004 from Kenya Agricultural and Livestock Research Organization in Katumani in Machakos County procured and distributed to agro-pastoralist groups in Poro ward of Samburu Central Sub-County.

4.3.2 Acreage of Sweet Potatoes

The summary of respondents and acreage of sweet potatoes were indicated in the Table 5.

Table 5*Acreage of Sweet Potatoes*

Acreage of sweet potatoes	Frequency	Percent
.000	31	31.3
.025	4	4.2
.125	1	1.1
.250	49	51.6
.500	5	5.3
1.000	6	6.3
1.025	1	1.1
2.000	2	2.1
Total	99	100.0

The respondents at 51.6 percent had 0.25 acre of sweet potatoes then followed by 31.31 percent, who did not cultivate any sweet potato. These findings shown that less acreage of sweet potato was produced, despite the crop ability to yield under adverse climatic and poor soil conditions, adoption is still rated low. The availability and accessibly of the recommended vines and the cost of planting materials (vines) might have hindered sweet potato production, as compared to other seed varieties, which are readily available at the local agro-dealers when agro-pastoralists need them. It was observed that agro pastoralists cannot keep sweet potato vines for the next planting season because of recurrent and extreme drought spell. Availability of sweet potato vines when agro pastoralists need them might have been a challenge because of the far distance to the source of the vines. Although sweet potato production has been promoted through demonstrations of proper agronomical practices of the crop, its acreage is low as compared to other crops as illustrated in Table 5.

4.3.3 Duration in Years of Sweet Potato Production

The duration of production of sweet potatoes by agro pastoralists in number of years from the time they were given the vines is as illustrated in Figure 2. Respondents at 49 percent did not indicate the years they have been growing sweet potatoes, implying that they did not plant the vines. It was also shown that 43.56 percent planted sweet potatoes for four years, whereas 1.98 percent did it for three years. The respondents, who were at 5.46 percent, did farming for the crop in five years. The findings shown that the crop was fairly adopted

and not as expected. Although findings, showed that agro pastoralists were reluctant to plant sweet potato instead of other crops. This might be attributed to the results of Jena *et al.* (2012) which stated that farmers allocate their few resources to produce the traditional cereal crops such as maize, barley, and wheat. These crops fetch good prices in the market because of their high demand.

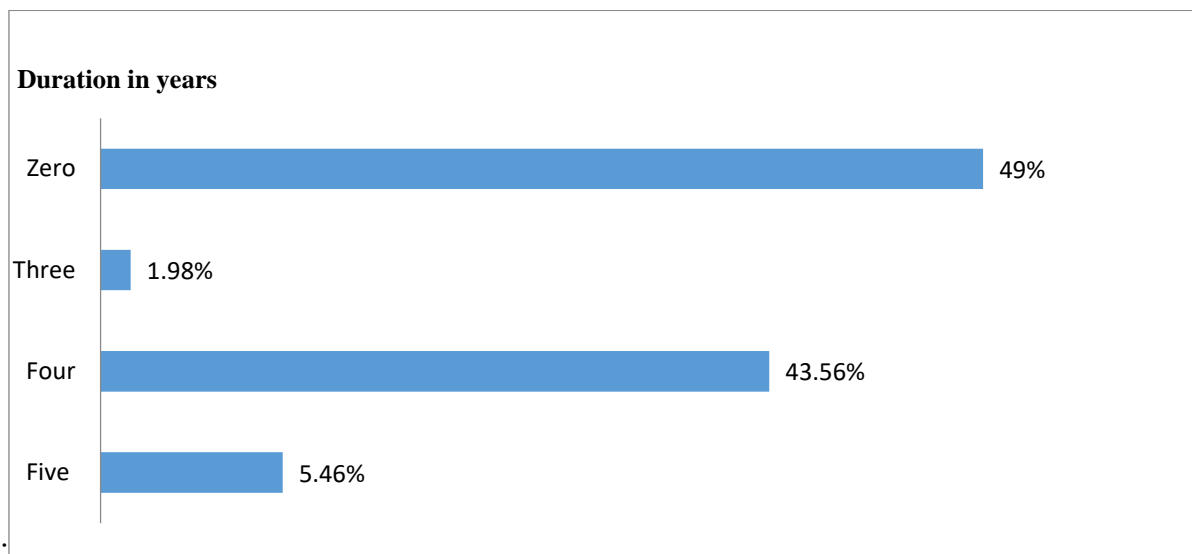


Figure 2. Percentage of Respondents Growing Sweet Potatoes

4.3.4 Bulking of Sweet Potatoes

The respondents, who bulked sweet potato vines were 29.3 percent, while those who did not bulk were the highest number at 66.7 percent (Table 6).

Table 6

Bulking of Sweet Potato Vines

Respondents respond	Frequency	Percent
Yes	29	29.3
No	66	66.7
Total	99	100.0

From the findings, less bulking of the vines might have contributed to lower acreage of the crop. According to a study by Zawedde *et al.* (2014) loss of planting materials due to drought was a major constraint to maintaining varietal diversity and sharing of this vegetative propagated crop.

4.3.5 Sharing of Sweet Potato Vines

The sharing of sweet potato vines did not achieve what was expected as shown in Table 7.

Table 7

Sharing of Sweet Potato Vines

Number of sweet potato vines distributed per respondent	Frequency	Percent
0	67	67.68
20	26	26.26
40	2	2.02
50	4	4.04
Total	99	100.00

Most respondent's 67.68 percent who were given sweet potato vines did not share the vines with other agro pastoralists, while 26.26 percent of them distributed each 20 vines to others. A 2.02 percent of the respondents contributed a total of 40 vines each to other agro pastoralists. Lastly 4.04 percent donated 50 vines each to other agro pastoralists.

The informal agreement between World Vision and the agro pastoralists was for them to share with their neighbours, but from the findings, most of them did not share. This could have contributed to low acreage of sweet potato in the ward, because most of the agro pastoralists did not honour the informal agreement. Although Ndolo *et al.* (2001) stated that rotating sweet potato with maize improves farmers' incomes through higher yields of maize as well as profit from sweet potato. Since the time World Vision distributed the vines, the county has been going through recurrent drought, which might have contributed to low sharing of the crop. Findings from Focus Group Discussion (FGD) with agro pastoralists indicated that, the county went through dry spell for a prolonged period, where some of them gave most of their sweet potatoes to livestock for survival. This reduced the distribution of the vines to other agro-pastoralists most likely due to drought, which might have wiped out the vines. The Key informants indicated that the County experienced drought, which might have led to low production of sweet potato in Poro ward.

4.4 Social Factors Influence on Sweet Potato Production

The first objective of the study was to determine the perception of agro pastoralists towards influence of social factors on sweet potato production in Poro ward, Samburu Central

Sub-County. The research question stated, what is the perception of agro pastoralists towards influence of social factors on sweet potato production in Poro ward, Samburu Central Sub-County? The findings and discussion on the various aspects of social factors in relation to sweet potato production were presented in the following sections:

4.4.1 Community Tradition and Sweet Potato Production

The community’s tradition did not interfere with the production of sweet potato as illustrated in Figure 3.

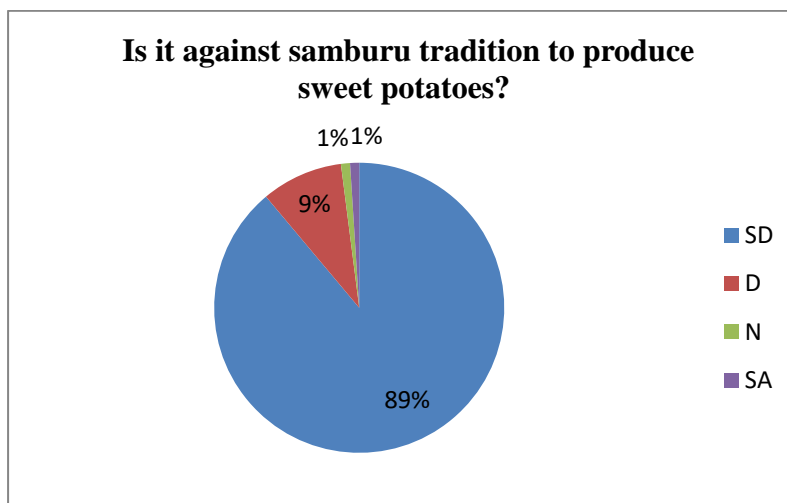


Figure 3. Tradition and Sweet Potato Production

The findings showed that 89 percent of the respondents strongly disagreed (SD) that community tradition was a hindrance to sweet potato production, followed by 9 percent of respondents, who disagreed (D), while both neutral (N) and strongly agreed (SA) were at 1 percent each. Therefore, low production of sweet potatoes could be attributed to other reasons rather than the respondent’s values and beliefs. The study findings indicated that community tradition was not a barrier to the production of sweet potato. Although the work of other studies in this area by (Diale, 2010 & Mazuze, 2004) indicated that cultural influences was among the key factors that affect adoption of technology positively. The findings also by Oywaya-Nkurumwa *et al.* (2011) stated that social and cultural factors were a major concern to adoption of agro-pastoralism among the Maasai people.

4.4.2 Views of Respondents on Growing of Sweet Potatoes

The views of respondents on growing of sweet potatoes are noted in Figure 4.

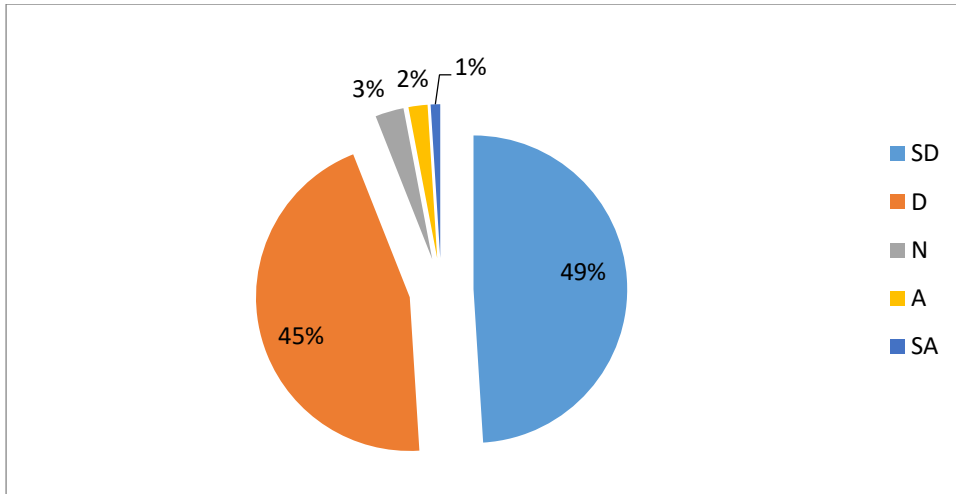


Figure 4. Sweet Potato Production and Social Status

The respondents were asked if production of sweet potatoes was associated with poor persons. About 49 percent of them strongly disagreed, while 45 percent disagreed and then 3 percent were neutral. Strongly agreed were at 2 percent and agreed at 1 percent. The findings stated that majority of respondents indicated that sweet potato production was not associated with poor persons. This could be because, when maize fails due to unreliable rainfall, sweet potato could be harvested and used as food by agro pastoralists, who got the vines. Agro pastoralists with few livestock embraced sweet potato production, as they cannot sell all the livestock to purchase food during normal dry seasons. This means sweet potato production was appreciated by poor people with few livestock, since the animal numbers indicate wealth in Samburu. However, Scott *et al.* (2000) reported that sweet potato production among the communities in Kenya was considered as a poor man’s food mainly used by resource limited households. In the Focus Group Discussion (FGD), agro pastoralists were asked to state and describe some of the community beliefs about growing sweet potatoes. The members in the group stated that sweet potato is a new crop and was not commonly produced in the area, but no cultural belief was attached to it. They however suggested that if the crop was referred to by its local name like *njasi namelok*, which means a wild tuber but sweet, which is eaten by pastoralists in the lower lands during drought, it can be used as food thus enhance production. The study by Aldow (2017) who examined factors affecting sweet potato production in crop–livestock farming systems in Ethiopia on the other hand observed that culturally, local people prefer to eat cereal crops rather than sweet potato, because the government assigns more money and research to increase cereal crop and cash crop production.

4.4.3 Community Perception on Producers of Sweet Potatoes

The findings shown that 68 percent of the respondents strongly disagreed, that they have been looked down because of planting sweet potato, while 27 percent of them indicated that they disagreed with the same statement. Then 1 percent of respondents each indicated agreed and neutral, while the remaining 3 percent of them stated strongly agreed, as shown in Figure 5.

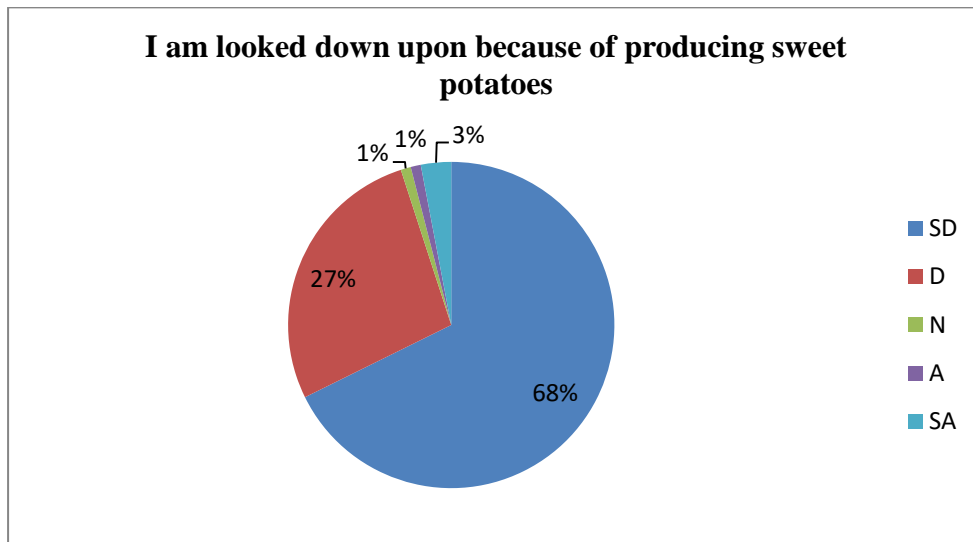


Figure 5. Perception towards Producers of Sweet Potatoes

The findings indicated that majority of the respondents were not looked down upon for growing sweet potatoes. This may imply that the agro pastoralists value the crop as a dual purpose, for example they are used as food and as fodder for livestock. Although according to Scott *et al.* (2000) report that sweet potatoes production among the communities in Kenya was considered as a poor man's food mainly used by resource limited households. However, in the Focus group discussion, the respondents stated that they used sweet potato leaves as vegetables so they request their neighbours to share the leaves to cook as vegetables during dry spell. Majority of the respondents further stated that their sweet potato crop provided fodder for the livestock during dry spell.

4.4.4 Reasons for Growing of Sweet Potatoes

Respondents gave several reasons regarding the cultivation of sweet potatoes, as shown in Figure 6.

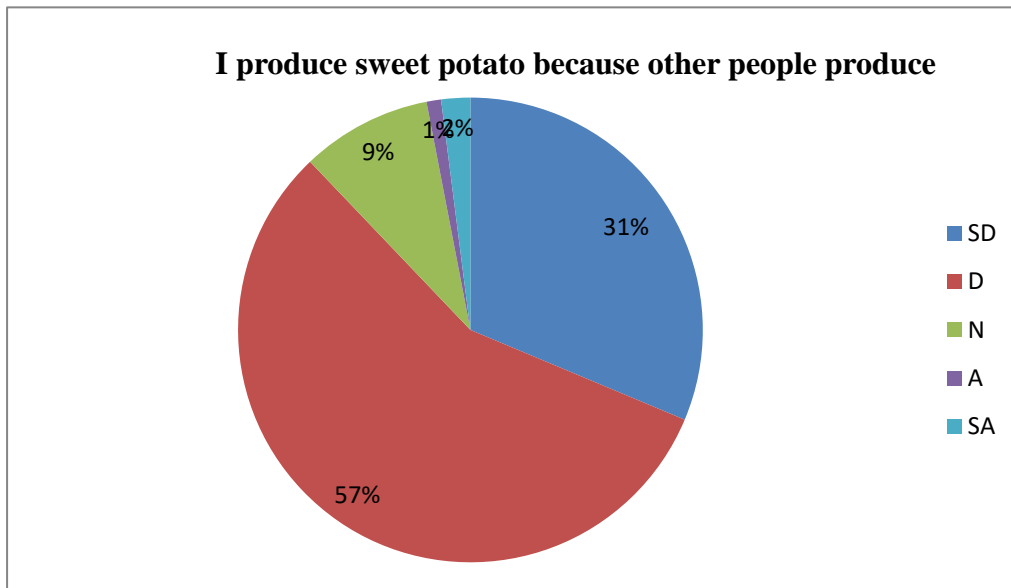


Figure 6. Community Perception towards Producers of Sweet Potatoes

The findings stated that 57 percent of the respondents disagreed with the statement that production of sweet potato is done because other people produced, while 31 percent indicated strongly disagreed with production of the crop because others planted. The respondents who stated neutral were at 9 percent. Those who strongly agreed and agreed, were the least at 2 percent and 1 percent respectively. The findings indicated that respondents produced sweet potatoes voluntarily. Kidane *et al.* (2013) in their study on nutritional analysis of vitamin A enriched bread from Orange Fleshed sweet potato and locally available wheat flours at Samre Woreda, Northern Ethiopia approved the study findings and indicated that the crop is a good source of vitamin A, which can tackle vitamin A deficiency among children.

4.4.5 Comparison of Yields of Sweet Potatoes and Other Crops

Comparing the yields of sweet potatoes and other crops gave the respondents an opportunity to have a choice as illustrated in Figure 7.

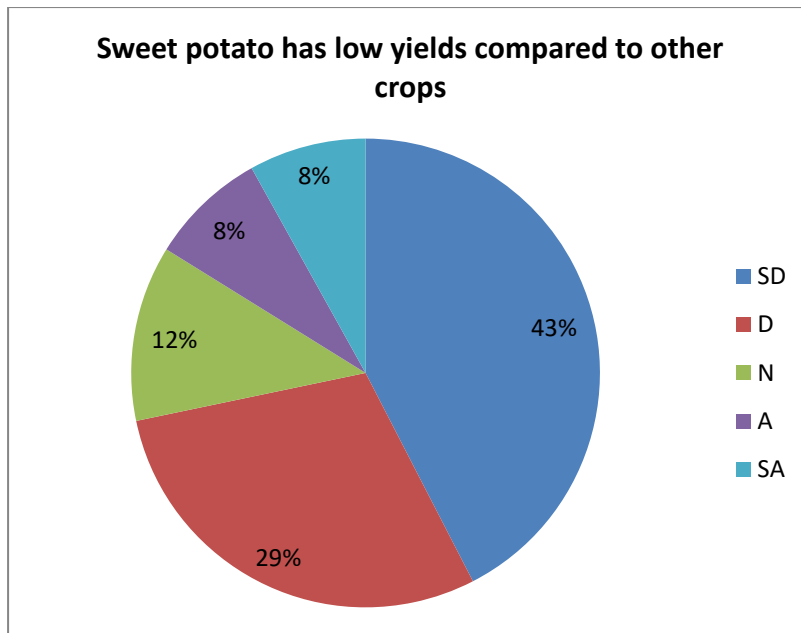


Figure 7. Comparison of Yields of Sweet Potatoes and Other Crops

The question which was asked to the respondents stated that, it is believed sweet potato has low yields compared to other crops. The majority of respondents at 43 percent strongly disagreed that sweet potato has low yields compared to other crops, followed by 29 percent, who disagreed with the same question, while 12 percent were neutral and finally 8 percent each for strongly agreed and agreed respectively. In a meta analysis study by Daryanto *et al.* (2016) sweet potato yields more protein and calories per unit area than either maize or Irish potato. Apart from yields, sweet potato is a very important crop as stated by Krochmal-Marczak *et al.* (2013) in their study on nutrition value of the sweet potato cultivated in South–eastern Polish conditions, that the value of sweet potato leaf as containing protein and crude fiber which are vital for addressing deficiency diseases and colon diseases.

4.4.6 Difficulty in Production of Sweet Potato Compared to Other Crops

The respondents' views on how difficult it is to plant sweet potato as compared to other crops, is indicated in Figure 8.

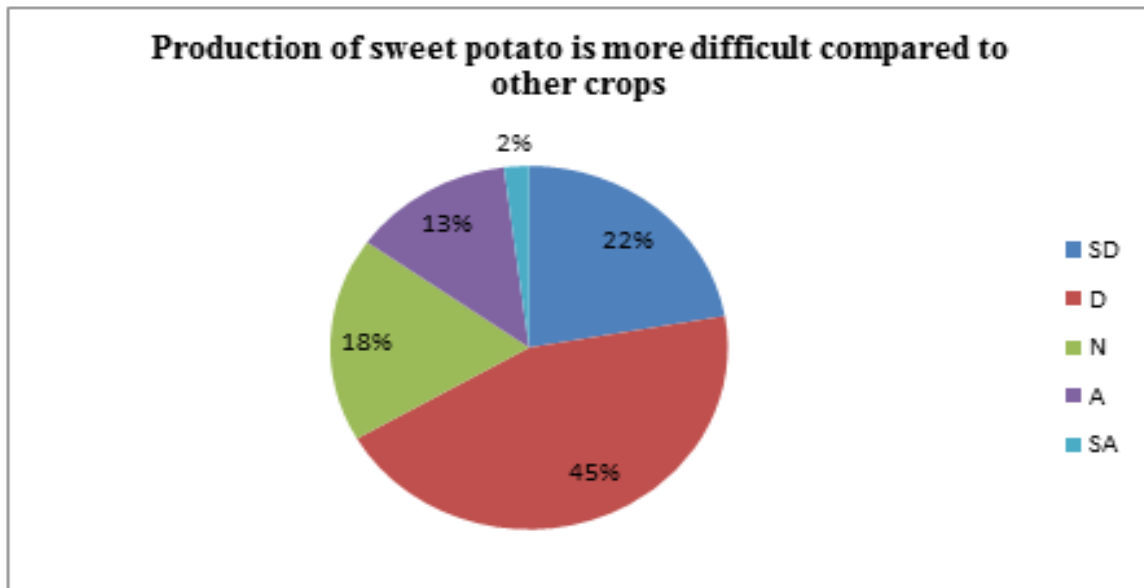


Figure 8. *Production of Sweet Potato is more Difficult Compared to Other Crops*

The findings of the study stated that 45 percent of the respondents disagreed, and then followed by 22 percent, who strongly disagreed, while 18 percent were neutral. Those who strongly agreed and agreed were 2 percent and 13 percent respectively. Most of the respondents stated that production of sweet potato was not difficult as compared to other crops. The findings agreed with Kimenyie and McEwan (2014) who observed that the ability of sweet potato to establish ground cover very fast enables suppression of weeds such as *Striga spp*, parasitic weeds, which attack the roots of crops such as maize, millet, sorghum and upland rice. Sweet potato also controls soil erosion, maintain soil fertility; hence it is an attractive crop for farming system and needs less weeding labour as compared to other crops.

4.4.7 Value for Livestock compared to Sweet Potato Production

The study explored how members of the family value livestock compared to sweet potato production. The value for livestock compared to sweet potato production is high. Although agro-pastoralists are keeping livestock and tilling land, they rate livestock higher as compared to sweet potato production, as shown in Figure 9.

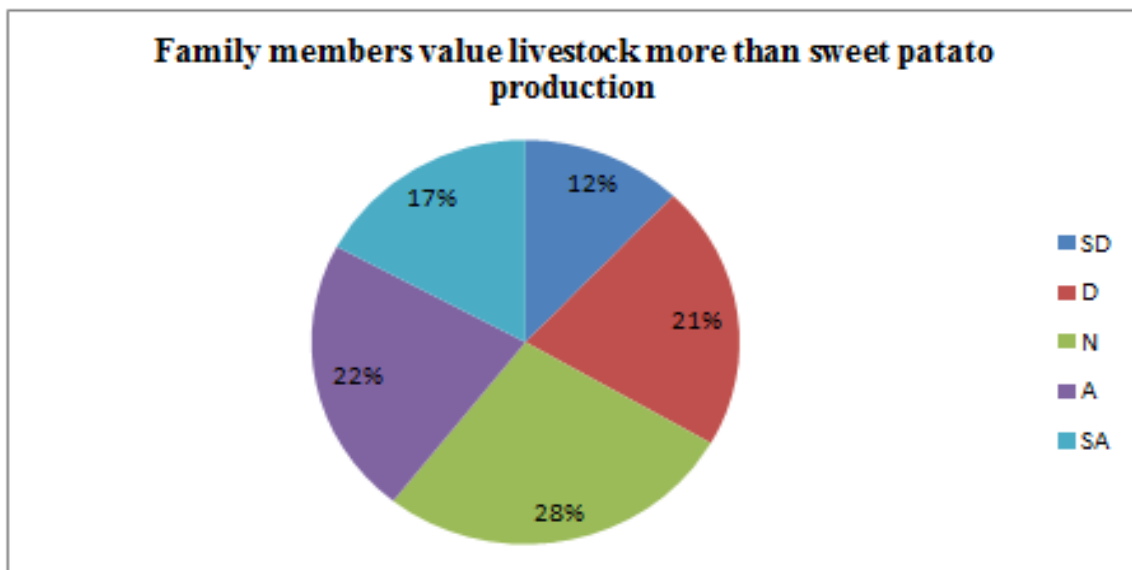


Figure 9. Family Value of Livestock Compared to Sweet Potato

The study found that 28 percent of respondents were neutral, and then 22 percent and 21 percent agreed and disagreed respectively. Strongly agreed were at 17 percent and then strongly disagreed constituted 12 percent. The findings from the respondents who agreed were slightly higher than those who disagreed. This was an indication that the agro-pastoralists were still embracing livestock keeping as compared to sweet potato farming. The slow pace of adoption is attributed to the fact Samburu men were proud pastoralists whose life revolved around cattle and disliked tilling of land (Lenaiyasa *et al.*, 2020; Rufino *et al.*, 2013). According also to Iannotti and Lesorogol (2014) pastoralist communities have traditionally depended on animal foods in their diets. But environmental and political pressures in recent years have led millions to agriculture and other income diversification strategies.

4.4.8 Sweet Potato as Family Staple Diet

The respondents stated their views on sweet potato production as a family staple diet as illustrated in Figure 10.

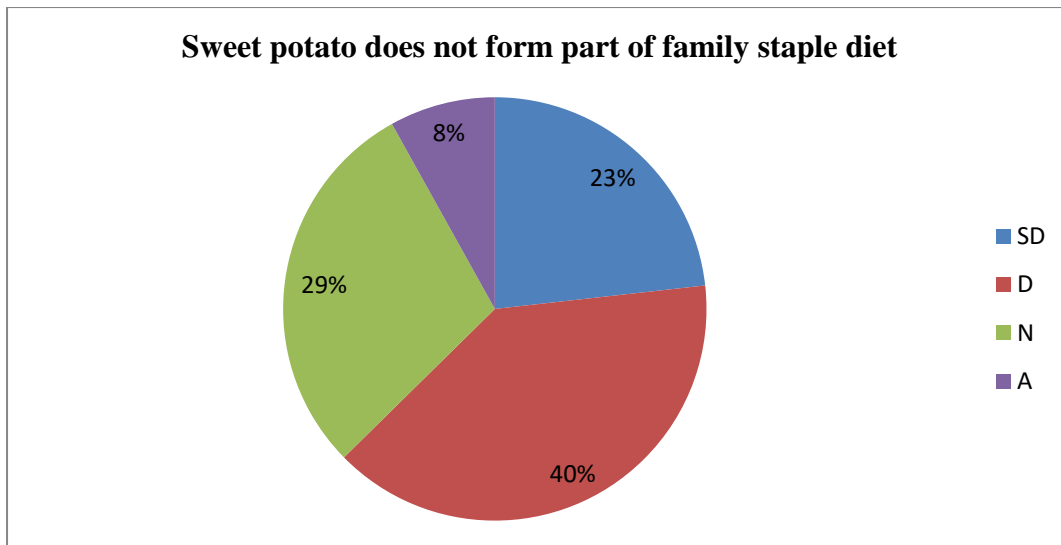


Figure 10. *Sweet Potato as Family Staple Diet*

The findings indicated that 40 percent of respondents disagreed with the statement that, sweet potato does not form part of family staple diet, while 29 percent were neutral and then followed by 23 percent indicating strongly disagreed. The least scored 8 percent for agreed. The findings showed that most of the respondents do support sweet potato as part of family staple diet. It was a positive indication towards production of sweet potato by the agro-pastoralists and if supported with certified vines. De Janvry *et al.* (2011) stated that transformation of subsistence farming to modern and commercial agriculture will enhance household food security and reduce poverty. Although according to Aldow (2017) local people culturally prefer to eat cereal crops rather than sweet potato.

4.4.9 Sweet Potato Production in Relation to Growing of the Crop by neighbours.

The respondents indicated their views on sweet potato production in relation to growing by people in the neighbourhood as shown in Figure 11.

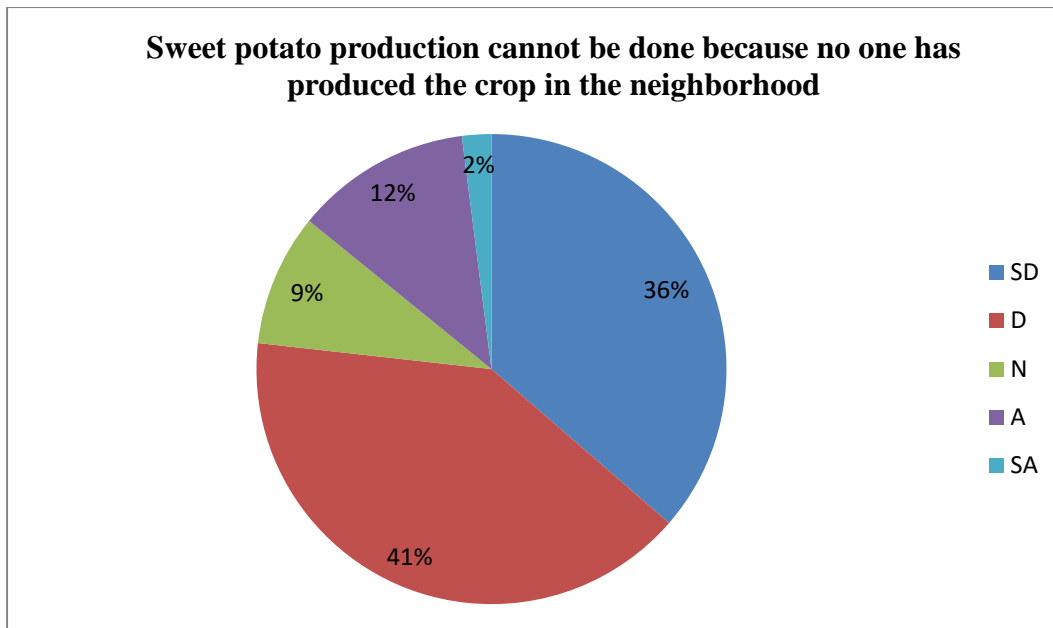


Figure 11. *Vines Production and Neighbourhood Growing of the Crop*

The respondents at 41 percent disagreed with the statement, sweet potato production cannot be done because no one has produced the crop in the neighbourhood, followed by 36 percent indicating strongly disagreed on the same. Those who stated neutral were at 9 percent. The respondents who agreed and strongly agreed constituted 12 percent and 2 percent respectively. It was evident that majority of the respondents were able to plant sweet potato without external influence. The findings differ with those by Magemba *et al.* (2012) who reported that influence from the neighbourhood significantly and negatively affected the extent of shift from pastoral to agro-pastoral farming systems. The group members of FGDs stated that as the community members lived in clusters, (*lmitito*) it would be easy to share ideas and production resources as they socialize. They also indicated that they do not have any negative belief on sweet potato production, as it is just a new crop. Langyintuo and Mekuria (2005) in their study established that as farmers interact more with their neighbours and outside world, they become abler to assess the relevance of new technologies and ideas thus they exercise a choice.

4.4.10 Family Members Support of Sweet Potato Production

The findings on the support of family members on sweet potato production are presented in Figure 12.

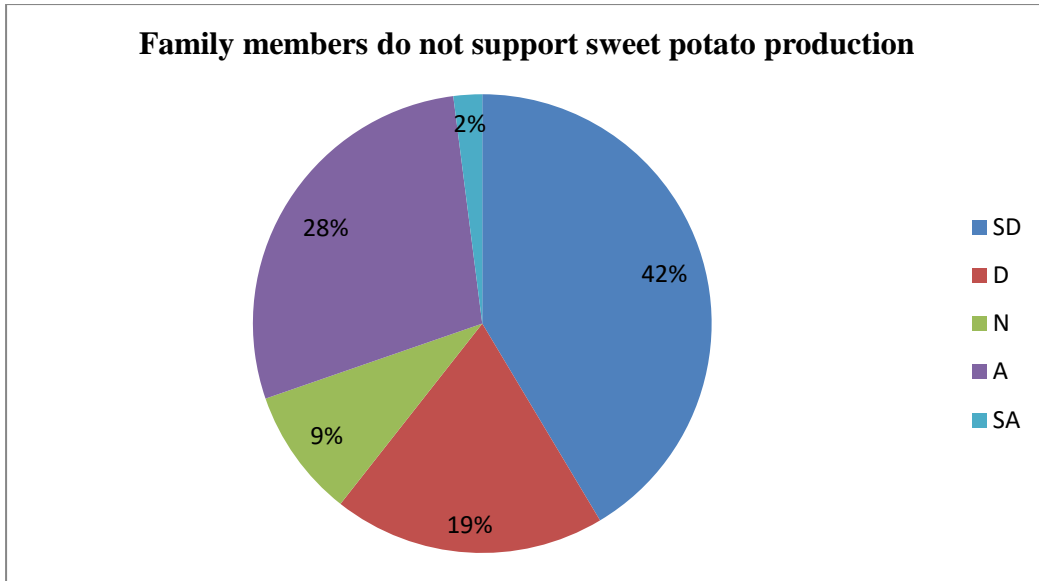


Figure 12. *Family Members and their Support on Sweet Potato Production*

The question on family do not support sweet potato production was answered by the respondents as follows; those who indicated strongly disagreed were at 42 percent, while those who agreed with the question were 28 percent and then 19 percent disagreed, while 9 percent and 2 percent consisted of neutral and strongly agreed respectively. Majority of families support the production of the crop as stated that the establishment of the organization in the area was by the effort of Samburu community members, who embraced enhancement of food and nutrition security through production of sweet potatoes at household level (SAPLIP 2016). On the other hand, among the group members in FGD, they stated that during the dry spell they were using sweet potato leaves as vegetables, instead of buying costly vegetables. Eating sweet potato tubers with tea without sugar has reduced the cost of sugar at household level. Some of the agro pastoralists purchased sweet potato tubers from the town and eat with their families instead of buying costly bread. They indicated that sweet potato has a lot of calories and when eaten you do not get hungry the whole day. They also highlighted that, they mainly cook sweet potato tubers for herders who look after livestock the whole day, without coming home for lunch break.

4.4.11 Traditional Beliefs and Acreage of Sweet Potatoes

The 42 respondents, who had 0.25 acre of sweet potatoes strongly disagreed that sweet potato production was against Samburu traditional beliefs, while 31 of them who did not possess any acreage of the crop also strongly disagreed on the same as shown in Table 8.

Table 8*Tradition and Acreage of Sweet Potatoes*

Tradition	Acreage of sweet potatoes (Acres)							
	.00	.025	.13	.25	.50	1.0	1.03	2.0
Strongly Disagree	31	3	0	42	4	5	1	2
Disagree	0	0	1	6	1	1	0	0
Neutral	0	0	0	1	0	0	0	0
Strongly Agree	0	1	0	0	0	0	0	0

The findings stated that Samburu traditions is not a factor affecting acreage for sweet potato production in Samburu Central Sub-County, as shown in Table 10. Those who did not have the crop must have lost during recurrent. However, according to Aldow (2017) local people culturally prefer to eat cereal crops rather than sweet potato. Although according to Nungo *et al.* (2007) the crop provides opportunities to use it as an entry point to strengthen nutrition and economic outcomes for women and their children, cultural and gender-defined roles need to be addressed to improve outcomes at household and community level.

4.4.12 Traditional Beliefs and Sweet Potato Production in Years

The respondents' views on traditional beliefs and specific duration of sweet potato production as illustrated in Table 9. The numbers 0-5 represent duration of growing sweet potatoes in years by agro pastoralists.

Table 9*Traditions and Duration of Producing Sweet Potatoes in Years*

Traditional Beliefs	Duration of producing sweet potatoes in years					
	0	1	2	3	4	5
Strongly Disagree	2	35	2	38	10	1
Disagree	0	3	0	6	0	0
Strongly Agree	0	0	0	0	1	0

Majority of the 38 respondents, who had planted sweet potatoes for 3 years, strongly disagreed that traditional beliefs were a hindrance of the crop growing, while 10 respondents, who had grown the crop for 4 years, strongly disagreed that traditional beliefs were preventing growing of sweet potatoes. The findings showed that traditional beliefs do not influence the duration of growing of sweet potatoes by agro pastoralists (Table 9).

4.4.13 Traditional Beliefs and Bulking Vines for other Agro-Pastoralists

It is evident that 59 respondents, did not bulk sweet potato vines for other agro pastoralists but strongly disagreed that production of the crop was against Samburu beliefs. This was followed by 25 of them who planted sweet potato vines for other agro pastoralists, also strongly disagreed that tradition was a hindrance to production of the crop, as summarized in Table 10.

Table 10*Traditions and Bulking Sweet Potato Vines for Other Agro-pastoralists.*

Traditional Beliefs	Bulking sweet potato vines for other agro pastoralists	
	Yes	No
Strongly Disagree	25	59
Disagree	3	6
Strongly Agree	0	1

From the findings, Samburu traditions do not affect the bulking of vines for other agro pastoralists. As most of the respondents were in communal land, the livestock might have fed on the crop during prolonged and recurrent drought for survival.

4.4.14 Acreage of Sweet Potatoes and Association of the Crop with Poor Persons

The findings as shown in Table 11 indicated that 26 respondents, who planted 0.25 acre of sweet potatoes strongly disagreed that the crop is associated with poor persons, followed by 20 respondents, who possess the same acreage, disagreed that the crop is associated with poverty. Most of the respondents disagreed that sweet potato was attached to poverty.

Table 11

Acreage of Sweet Potatoes and Association of the Crop with Poor Persons

Association with poor Persons	Acreage of sweet potatoes (Acres)				
	.00	.025	.125	.25	.50
Strongly Disagree	8	2	1	26	5
Disagree	22	1	0	20	0
Neutral	1	0	0	1	0
Agree	0	0	0	2	0
Strongly Agree	0	1	0	0	0

From the findings the crop is socially accepted. Despite the potential of sweet potato in helping to meet Kenya's food needs and poverty reduction through income generation, detailed information on sweet potato demand relations is unavailable to enable the traders plan their production and marketing activities (Ongoro & Ogara, 2021).

4.4.15 Duration of Vines Production in Years and Association with Poor Persons

Among the respondents who had planted sweet potato for 3 years, 33 disagreed that the crop was associated with poverty, followed by 11 respondents who strongly disagreed that sweet potato growing was for poor persons. Of those respondents who had grown the crop for 1 year, 9 strongly disagreed that sweet potato growing was attached to poverty, as shown in Table 12.

Table 12*Duration of Sweet Potato Production in Years and Association with Poverty*

Association with Poor Persons	Duration of producing sweet potatoes in years					
	0	1	2	3	4	5
Strongly Disagree	1	25	1	11	9	1
Disagree	1	9	1	33	1	0
Neutral	0	2	0	0	1	0
Agree	0	2	0	0	0	0
Strongly Agree	0	1	0	0	0	0

From the findings, many of them disagreed that sweet potato is associated with poor persons. The findings indicated that the duration of sweet potato farming is not associated with poverty.

4.4.16 Bulking Vines for other Agro-Pastoralists and Association with Poor Persons

The findings as shown in Table 13 indicated that 36 and 28 of the respondents who did not bulk sweet potatoes vines for other agro-pastoralists disagreed and strongly disagreed that production of sweet potatoes is associated with poverty and 17 of respondents who bulked sweet potato vines for other agro-pastoralists strongly disagreed on the same.

Table 13*Bulking Vines for Other Agro-pastoralists and Association with Poor Person*

Association with Poor Persons	Bulking vines for other agro pastoralists	
	Yes	No
Strongly Disagree	17	28
Disagree	8	36
Neutral	1	2
Agree	2	0
Strongly Agree	1	0

The implication is that bulking of sweet potato vines for other agro-pastoralists is not associated with poverty. Although from the findings respondents did not indicate that sweet potatoes is associated with poverty. But according to Oluoko-Odingo (2011) poor and hungry populations are less resilient to stress and disasters and rely a great deal on the natural

environment, as they lack the capacity and the resources required to recover from disasters. The current projected climatic change is likely to have a great impact among food-insecure and poor populations due to the projected effects on food availability, water resources, and health, as well as accessibility to infrastructural services, which is minimal, if not lacking completely, among vulnerable and poor households.

4.4.17 Acreage of the Crop and Family Members Value for Livestock

It is evident that 13 and 9 respondents all with 0.25 acre of sweet potato strongly agreed and agreed respectively that agro pastoralists value livestock more than the crop production. Although 5 and 9 of them with 0.25 acres strongly disagreed and disagreed respectively that livestock keeping was more valuable, as compared to the crop production (Table 14).

Table 14

Acreage of Sweet Potatoes and Family Household Value for Livestock

Family members value livestock	Acreage of sweet potatoes (Acres)							
	.00	.025	.125	.25	.5	1.0	1.025	2.0
Strongly Disagree	4	0	0	5	1	0	1	1
Disagree	8	2	0	9	1	1	0	0
Agree	16	0	0	9	0	2	0	0
Strongly Agree	3	1	1	13	3	0	0	1

From the findings most of the respondents agreed and strongly agreed that livestock keeping was more worth than sweet potato production. Although sweet potato can play a very important role in food and nutrition security strategy for Kenya since it is drought resistant, it is a relatively short term crop with flexible time of harvest allowing a high degree of flexibility in food availability and finally it improves the yield of maize in a crop rotation compared to continuous maize production (Gibney & Wiersma (1986). But the respondents still value livestock keeping as compared to sweet potato production. Oywaya-Nkurumwa *et al.* (2011) added that livestock is tightly intertwined in the Maasai economy and social structure, religion, and relationships, which is almost similar with the Samburu pastoralists.

4.4.18 Duration of Sweet Potato Production and Family Members Value Livestock

The views of respondents on duration of producing sweet potatoes and family members' value for livestock were summarized on Table 15.

Table 15

Duration of Producing Sweet Potatoes and Family Members' Value for Livestock

Family members value livestock	Duration of producing sweet potatoes in years					
	0	1	2	3	4	5
Strongly Disagree	1	2	0	3	6	0
Disagree	0	11	1	7	1	1
Agree	1	3	0	23	0	0
Strongly Agree	0	10	1	7	4	0

According to 23 respondents who had planted sweet potatoes for 3 years, they agreed that family members value livestock keeping more than sweet potato production. The 10 and 7 respondents who had planted sweet potatoes for one and 3 years respectively agreed that livestock keeping was more valuable than sweet potato farming. However, 7 and 11 of them, who had planted the crop for one and 3 years respectively disagreed that livestock keeping was more valuable as compared to sweet potato farming as illustrated in Table 15. The findings indicated that most agro pastoralists agreed that they value livestock keeping more than sweet potato production.

4.4.19 Suggestions of Improving Sweet Potato Production by Agro-Pastoralists

The respondents gave their suggestions on improving sweet potato production as shown in Table 16. Most respondents at 51 percent indicated that they required more trainings, while 28 percent of them requesting for sweet potatoes planting vines. Those, who supported financial support, were at 11 percent and lastly 10 percent of them stated contact with other agro pastoralists, who produce sweet potatoes.

Table 16*Ways of Improving Sweet Potato Production by Agro pastoralists*

Responses	Percent
Trainings	51
Provision of sweet potatoes vines	28
Financial assistance	11
Contact with other agro pastoralists	10
Total	100

From the findings most of the respondents stated that further training was a way in which the agro pastoralists can improve sweet potato production. In FGD, the members suggested that there is need to involve in some of the local groups and organizations in order to take up their specific roles on extensive promotion on utilization of sweet potatoes tubers as food and leaves as vegetables, livestock feed as well as income generator. The institutions and local groups include National and County governments, religious leaders, local leaders, women groups, youth groups, local media (*serian*), nutritionists, agri- nutritionists, patrons of young farmers and 4K clubs.

4.5 Economic Factors on Influence Sweet Potato Production

The second objective in the study was to determine perception of agro pastoralists towards influence of economic factors on sweet potato production in Poro ward, Samburu Central Sub-County, while the research question was what perception of agro pastoralists towards influence of economic factors on sweet potato production in Poro ward is, Samburu Central Sub-County The findings in relation to economic factors are presented and discussed in the following sections.

4.5.1 Sources of Income

The findings on the respondents' sources of income for the family is shown in Figure 13. These indicated that 86.9 percent of the respondents got their income from livestock, while 9.1 percent of them received their source of income from other sources. The least percentage of income was from sweet potato at 2 percent.

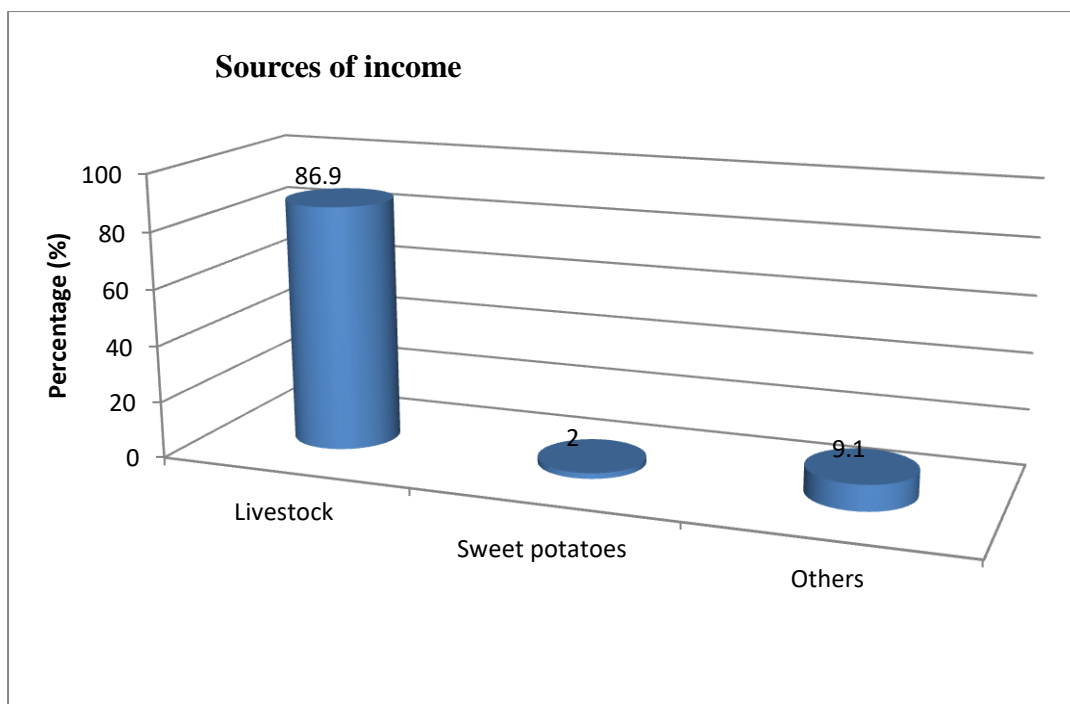


Figure 13. *Sources of Income for the Family*

This study provided evidence that advocacy of sweet potato production as a source of income is still low as compared to livestock keeping. This is because over 80 percent of respondents agreed that their income was solely dependent on livestock rearing compared to agro pastoralism in this case sweet potato farming. Agricultural Sector Development Strategy (2010) also stated that both crop farmers and pastoralists keep livestock for food and income generation, although in Samburu Central, the agro pastoralists depend mainly on livestock and may be other crops apart from sweet potatoes. According to Odendo *et al.* (2002) stated that rotating sweet potato with maize improves farmers' incomes through higher yields of maize as well as income from sweet potato.

4.5.2 The Number of Cattle that the Respondents Kept Yearly

The findings in Table 17 indicated that 63.6 percent of the respondents kept less than 10 cattle yearly, while 11.1 percent of them kept from 11-20 cattle annually. Those who kept 21-30 cattle were few at 4 percent.

Table 17*Number of Cattle Respondents kept Yearly.*

Number of cattle kept yearly	Frequency	Percent
0	19	19.2
Less than 10	63	63.6
11-20	11	11.1
21-30	4	4.0

The findings shown that most of the respondents had less than 10 cattle, which can be considered low. This could be attributed to factors related to limited availability of pasture. According to Pas (2018) pastoral mobility is seen as the most effective strategy to make use of constantly shifting resources. However, mobile pastoralism as a highly valued strategy to manage grazing areas and exploit resource variability is becoming more complex, due to recurrent droughts, loss of forage, government-led settlement schemes, and enclosure of land for community conservation, among other reasons.

4.5.3 Selling of Livestock by Agro-Pastoralists as a Source of Income

The findings in Table 18 showed the income that agro pastoralists received from livestock sales.

Table 18*Income from Livestock for the Agro- pastoralists*

Number of cattle sold per year	Price sold per cow (KES)	Total cost (KES)	Frequency	Percent
7	20000	134000	67	67.68
2	30000	60,000	19	19.19
0	0	0	13	13.13
Total		191,000	99	100

About 67.68 percent of the respondents sold 7 cattle each annually at a price of 20.000 KES from which they earned most income of 134,000 KES. The 19.19 percent of them sold 2 cattle each for 30,000 KES. The findings show dependence on livestock as a source of income as 80 percent of the population of Samburu County earn their income from livestock (SCIDP, 2018).

4.5.4 Land System of Agro-Pastoralists

The respondents gave their response on land system, as illustrated in Figure 14.

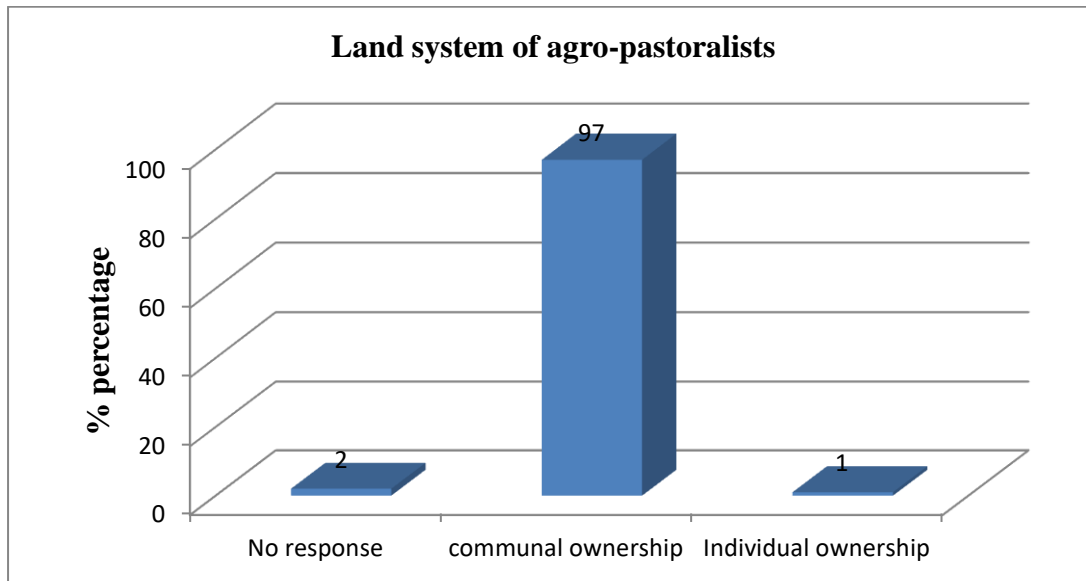


Figure 14. Land System of Agro pastoralists

The findings show that 97 percent of the respondents stated that their land system was communal, while private land ownership was minimal at one percent. Many respondents were in communal land system which might have implications in that livestock roam freely around the farms and sometimes enter agro pastoralists' farms, destroying whatever is grown, especially during prolonged drought. On freedom to plant sweet potatoes on communal land, majority of the respondents at 84.8 percent stated that they were allowed by other community members to grow sweet potatoes on the land, while 13.1 percent stated that they were not allowed to grow the crop. This implied that land was available for sweet potato production. Following a study by Zawedde *et al.* (2014) loss of planting materials due to drought was a major constraint to maintaining varietal diversity for this vegetative propagated crop. Lack of access to best management practices were also key constraints to maintenances of farmers' varieties. However, increased conversion of predominantly grazing land to commercial cultivation has led to competition for land resource between livestock and crops. The remaining land is increasingly privatized through subdivision and allocation of rights for grazing and farming enterprises.

4.5.5 Land System and Acreage of Sweet Potatoes

On acreage, 48 respondents had planted 0.25 acre on communal land. The findings indicated that 5 and 6 of them did farming of sweet potatoes on 0.5 and one acre respectively on communal land. On individual land, only one respondent produced the crop on 0.25 acre which was minimal. This is shown in Table 19.

Table 19

Land System and Acreage of Sweet Potatoes

Categories	Land system	
	Communal	Individual
Acreage (acres)		
0	29	0
0.025	4	0
0.125	1	0
0.25	48	1
0.5	5	0
1	6	0
1.025	1	0
2	2	0

The findings shown that there was higher production on communal land as compared to individual systems of land. According to Kirwa *et al.* (2012) in a study that sought to characterize the existing adaptive strategies and shifts in smallholder agro-pastoralists in relation to changes in land use and land subdivisions, found 20.5 percent of the respondents were of the view that better access to land was one of the factors that led to shifts by smallholder agro-pastoralists.

4.5.6 Land System and Duration of Sweet potato Production

On duration 44 of the respondents had planted sweet potato vines for 3 years on communal land, while 38 had grown the crop for one year also on communal land. There was one respondent on individual land who had grown the crop for one year (Table 20).

Table 20*Land System and Duration of Sweet Potatoes*

Duration in years	Land system in frequency	
	communal land	Individual land
1	38	1
2	2	0
3	44	0
4	11	0
5	1	0

From the findings most of the respondents were planting the crop on communal land. Rana *et al.* (2007) found that private land ownership with title deeds gives farmers a right to use the land. This creates an incentive for the farmers to make necessary investments in their land which are long term.

4.5.7 Land System and Bulking of Sweet Potato Vines

The findings indicated that 66 of the respondents in communal land did not bulk vines for other agro-pastoralists, while 28 of them bulked the vines for their neighbors. From the findings most of the respondents did not bulk the vines, which could have contributed to low acreage of the sweet potato. (Table 21). Agro-pastoralists in individual land could have bulked the sweet potato vines, because they had control over land use. However, the key informants noted that sweet potato production was still new to the agro pastoralists, which might have contributed to low bulking on both systems of land. The Focus group discussion members highlighted that the drought might have affected communal and individual land system in production of sweet potato.

Table 21*Land System and Bulking of Sweet Potato Vines*

Bulking	Land system in Frequency	
	Communal	Individual
Yes	28	1
No	66	0

4.5.8 Acreage of Sweet Potato and Income from Livestock

The 31 respondents who sold the livestock at 20,000 KES had 0.25 acre of sweet potatoes and 26 of them who also sold their cattle at 20,000 KES did not have the crop. The 13 of those who sold livestock at 30,000 KES had 0.25 acre. The findings shown that most respondents, who had 0.25 of the crops sold their livestock as illustrated in Table 22.

Table 22*Acres of Sweet Potato and Yearly Income from Livestock*

Price of Livestock (KES)	Acreege of sweet potatoes (Acres)							
	.0	.025	.125	.250	50	1.0	1.025	2.0
0	2	1	0	5	1	0	0	0
20,000	26	1	1	31	2	4	0	2
30,000	1	0	0	13	2	2	1	0

From the findings livestock keeping was an income generator to the respondents. According to Boone *et al.* (2005) despite the benefits associated with crop production, access to communal land for production purposes among the pastoralists community is based on complex social, cultural, and historical norms and conditions that historically have maintained flexible access to resources across space and time. Lynn (2010) showed that cultivation for profits for Maasai in Simanjiro were largely positive, raising some below-subsistence pastoralists above the subsistence threshold and others toward it. The study found that resilience is increased as a product of both intermittent food production and a quick potential food following drought, while livestock populations recover.

4.5.9 Duration of Sweet Potato Production and Cost of Livestock Yearly

The findings showed that 42 of the respondents who sold each livestock at 30,000 KES were on the 3rd year of sweet potato production and 22 of those who sold at 20,000 KES were in the 1st year of sweet potato farming (Table 23).

Table 23

Duration of Sweet Potato Production and Cost of Livestock Yearly

Price of Livestock yearly in KES	Duration of sweet potato production				
	1 Year	2 Years	3 Years	4 Years	5Years
0	2	0	0	1	0
20,000	22	1	2	3	0
30,000	8	1	42	5	0

From the findings most of the respondents, who did their farming on the 3rd year sold their livestock annually at higher price as compared to those on the 1st year of production of the crop.

4.5.10 Bulking of Sweet Potato Vines for Others and Income from Livestock

The livestock prices and bulking of sweet potato vines for other agro pastoralists are summarized by respondents, as shown in Table 24.

Table 24

Bulking of Sweet Potato Vines for Other Agro-pastoralists and Cost of Livestock

Price of Livestock (KES)	Bulking sweet potato vines for other agro pastoralists	
	Yes	No
0	2	6
20,000	1	50
30,000	10	9

The findings indicated 16 and 10 respondents bulked sweet potato vines and sold livestock at 20,000 KES and 30,000 KES respectively. However, 50 of them did not bulk sweet potato vines for other agro pastoralists, but they sold livestock at 20,000.00 KES (Table 24) From the findings most of the respondents who did not bulk sweet potato vines,

sold more livestock as compared to those, who bulked sweet potato vines for other agro pastoralists.

4.5.11 Acreage of Sweet Potatoes and Land System

The findings on land system and acreage of sweet potato produced are presented in Table 25.

Table 25

Acreage of Sweet Potatoes and Land system

Land System	Acreage of sweet potatoes (Acres)							
	.00	.025	.125	.25	.50	1.0	1.025	2.0
Communal land	29	4	1	48	5	6	1	2
Individual land	0	0	0	1	0	0	0	0

The sweet potato production was predominantly done on communal land and only one respondent produced sweet potato was done on 0.25-acre individual land. The most common acreage of land size under sweet potato production was 0.25 acre grown by 48 respondents. Only about 6 and 2 respondents had one and two acres of land respectively. The findings further indicate individual land ownership did not lead to more production of sweet potatoes as would be the expectation as more of their land is protected from livestock/wildlife crop destruction. It was noted that almost half of the respondents planted sweet potatoes on communal land, which showed that the other agro-pastoralists do not hinder production of the crop. The low production of the crop might be attributed to impacts of climate change in the form of droughts effect of the entire communities and presumably therefore, affect the lives of both women and men in several ways, as stated by Ongoro and Ogara (2012).

4.5.12 Land System and Duration of Sweet Potatoes in Years

The study sought to find out the number of years the respondents planted sweet potatoes with respect to communal and individual land system. The findings are presented in Table 26.

Table 26*Land System and Duration in Years*

Land system	Duration of producing sweet potatoes in years					
	0	1	2	3	4	5
Communal land	0	38	2	44	11	1
Individual land	0	1	0	0	0	0

The findings showed that 38 and 44 respondents had grown sweet potatoes for one year and three years respectively on communal land. There was not much sweet potato production on individual land system, although they were normally fenced. In that case the vines for planting could be available throughout the year due to less destruction by livestock/wildlife. Magemba *et al.* (2012), noted that land is a resource that facilitates agricultural activities. In a study that sought to evaluate the factors associated with shift from pastoral to agro-pastoral farming systems in Trans-Mara West Sub-County of Narok County Kenya. They also found that declining land sizes increased the shift to agro-pastoral farming by 0.8 percent.

4.5.13 Land System and Bulking of Sweet Potato for Other Agro-Pastoralists

The respondents at 66 on communal land did not bulk sweet potato vines for other agro pastoralists, while 28 bulked the vines on communal land system. Among respondents having individual ownership of land minimal number were able to bulk and share the sweet potato vines (Table 27).

Table 27*Land System and Bulking of Sweet Potatoes for Agro-pastoralists.*

Land system	Bulking vines for other agro pastoralists	
	Yes	No
Communal land	28	66
Individual land	1	0

From findings most of the respondents did not bulk the sweet potato vines for other agro pastoralists. This implies that low sweet potato production may be contributed by low bulking of the vines. This implies that low sweet potato production may be contributed by low bulking of the vines. Although according Diale (2011) in his study found that access to farm land was one of the factors that influenced adoption of hybrid sorghum cultivars in South Africa. Mazuze (2004) on the other hand, found farmland size had an influence on sweet potato farming in Mozambique.

4.5.14 Acreage of Sweet Potato and Extension Agents Visits

About 18 and 8 respondents with 0.25 acre of sweet potato disagreed and strongly disagreed respectively that extension agents frequently visit and advise them on sweet potato production. Those who agreed that extension agents were providing services sufficiently were 13 respondents, who had planted 0.25 acre of the crop as illustrated in Table 28.

Table 28

Acreage of Sweet Potatoes and Extension Agent's Advice on Sweet Potato

Acreage of sweet potatoes	Extension agents frequently visits and advice				
	SD	D	N	A	SA
.000	2	4	10	10	0
.025	0	4	0	0	0
.125	0	0	1	0	0
.250	8	18	10	13	0
.500	0	2	1	2	0
1.000	2	3	0	1	0
1.025	0	0	0	0	1
2.000	1	0	1	0	0

Generally, from the findings most respondents pointed out low frequency of visits by extension agents, which might have affected crop production partially. According to Amjath-Babu *et al.* (2016) some of the crop production challenges are inadequate extension services at all levels, lack of modern farming methods, post harvesting losses and high dependence on relief food.

4.5.15 Duration of Sweet Potatoes Production and Extension Agents Visits

In the duration of 4 years of sweet potato farming, 15 respondents agreed that extension agents visited and gave them advice on production of the crop and 6 respondents in 2 years agreed that the agents advised them on the same. However, in 4th year of production, 8 and 7 of them strongly disagreed and disagreed respectively with the frequent visit and advice by extension agents on production of sweet potatoes as summarized in Table 29.

Table 29

Duration of Sweet Potatoes Production and Extension Agents Visits and Advice

Duration of Extension agents' frequent visits and advice on sweet potato producing sweet production potatoes in years	of Extension agents' frequent visits and advice on sweet potato producing sweet production				
	SD	D	N	A	SA
2	0	2	1	6	1
3	1	0	0	1	0
4	8	7	14	15	0
5	0	1	0	0	0

From the findings few respondents received the advice from the extension agents, especially in 2nd and 3rd year of production of the crop. This implies that extension agents require several follow ups to enhance production of the crop. Onemolease and Alakpa (2009) revealed that farmers in contact with extension agents are two times more likely to increase adoption of crop-related innovations than those with no contact.

4.5.16 Bulking and Sharing of Vines and Extensions' Advice on Vines Production

In Table 30, the 14 respondents, who bulked and shared 20 vines each disagreed that they were been visited frequently and advised on the production of sweet potatoes by the extension agents. However, 5 respondents, who bulked and shared 20 vines each agreed that they received the extension services frequently and were advised. The 3 respondents, who bulked and shared 50 vines each agreed that they were been visited frequently and given advice on the sweet potato production.

Table 30*Bulking and Sharing of Vines and Extension Agents' Advice on Production*

Bulking of vines	Extension agents visit and advice on sweet potato production			
	SD	D	N	A
0	3	3	0	0
20	2	14	5	5
40	0	1	0	1
50	0	0	1	3

From the findings most respondents were not visited by extension agents, which might have resulted to low acreage of the sweet potatoes. Davis (2008) said extension services play a key role in providing information and promoting new technologies or new ways of managing crops and farms. Thus extension agents can introduce locally appropriate technologies and management techniques that enable farmers to adapt to new farming techniques Ali-Olubandwa *et al.* (2010) added that the extension services can be through results demonstrations, where two technologies are compared and method demonstrations, which are done to enhance a specific relevant technology required by participants, through model plots and group meetings. These are more effective in terms of time and services provided as compared to individual farm visits.

4.5.17 Acreage of Sweet Potatoes and Training on the Crop

The 25 respondents, who had 0.25 acre of sweet potatoes did not receive any training and 24 of them who did not plant sweet potatoes were also not trained. The respondents, who had 0.25 acre and were trained, were 24 of them as shown in Table 31.

Table 31*Acreage of Sweet Potatoes and Training on the Crop*

Acreage of sweet potatoes	Respondents trained on sweet potato production	
	Yes	No
.000	3	24
.025	0	4
.125	1	0
.250	24	25
.500	2	3
1.000	2	4
1.025	0	1
2.000	0	2

From the findings, most of the respondents with different acres of farm did not receive trainings. This might imply that the low acreage of sweet potato was contributed by few trainings of the respondents. This might be during the training most of the agro pastoralists might have shifted with livestock in search of pasture and water during drought. A study by Ali-Olubandwa *et al.* (2010) added that the extension services can be through results demonstrations, where two technologies are compared and method demonstrations, which are done to enhance a specific relevant technology required by participants, through model plots and group meetings. These are more effective in terms of time and services provided as compared to individual farm visits.

4.5.18 Duration of Sweet Potato Production and Training on the Crop

On the duration of 4 years on sweet potato production, 43 of the respondents were not trained, except 1 of them who got the training on the same year. On 2nd and 3rd year only 4 and 2 respondents were trained respectively. Majority of the respondents did not receive training on agronomic aspects of the crop, as summarized in Table 32.

Table 32*Duration of Sweet Potato Production and Training on Crop*

Duration of sweet potato production	Training on sweet potato production	
	Yes	No
2	4	7
3	2	0
4	1	43
5	0	1

This might be due to absentee agro pastoralists, who shifted their livestock in search of pasture and water during prolonged drought and were not available during on-site training. This is supported by Amjath-Babu *et al.* (2016) stated that, some of the crop production challenges are inadequate extension services at all levels, lack of modern farming methods, post harvesting losses and high dependence on relief food.

4.5.19 Bulking and Sharing of Vines and Training

The 13 trained respondents bulked and shared 20 vines each to other agro pastoralists, while the other 13 untrained respondents also bulked and shared 20 vines each to the agro-pastoralists. The 4 respondents also bulked and shared 50 vines each to other agro pastoralists, as shown in Table 33.

Table 33

Respondents Bulking and Sharing of Vines and Training on Sweet Potato Production.

Bulking and sharing of vines with agro pastoralists	Training on sweet potato production	
	Yes	No
0	1	5
20	13	13
40	1	1
50	4	0

The findings showed that the trained respondents bulked and shared slightly more vines as compared to those who never got the training. This means if more agro pastoralists were sensitized there could be more bulking and sharing of the vines, hence more sweet

potato production, hence more acreage of the crop. According to Chah *et al.* (2020), stated that extension agents should create more sensitization and provide education about OFSP to farmers. Additionally, concerted efforts should be made by the research institutes to provide adequate and easily accessible inputs (vines and other planting materials) so that more farmers can produce vitamin A rich OFSP.

4.6 Perception of agriculture extension agents towards factors influencing sweet potato production

The third objective was aimed at investigating the perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists in Poro ward, Samburu Central Sub-County. The research question was what is the the perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists in Poro ward, Samburu Central Sub-County? The study findings are presented and discussed in the following sections.

4.6.1 Categories of Extension Staff

The information was sought from key informants in the ministry of agriculture who worked closely with agro pastoralists ain the production of sweet potatoes. The ranking of the extension officers was Senior Agricultural Officer (SAO) followed by Agricultural Assistant (AA), Senior Agricultural Assistant (SAA), followed by Chief Agricultural Assistant (CAA) Assistant and Agricultural Officer (AO II). All the key informants were well trained in the field of agriculture production and thus were able to give an objective view on the growing of sweet potatoes by the agro pastoralists. According to Swanson (2008) & Davis (2008) extension service is to reduce the farm inputs, while increasing the productivity in a sustainable manner and also promoting new technologies The findings from the key informants are presented as follows:

4.6.2 Extension agent' Perception towards the Production of Sweet Potato

The perceptions of Agriculture extensions staff on sweet potatoes production were that sweet potato is the future drought tolerant crop, which can be relied on because of the frequent drought in the county. For example, when maize crop fails during drought, there is a likelihood that sweet potato will survive. Also, the key informants stated that community members being agro pastoralists take a long time to accept the growing of a new crop such as sweet potato. They noted that sweet potato is a very important crop, which can serve as food

crop, a vegetable and livestock feed and a rotational crop in pest/disease control process. As well, they saw it as an income generator if produced commercially.

4.6.3 The Challenges Faced by Agro-Pastoralists on Sweet Potatoes Production

The extension agents stated their views on economic and social factors influencing sweet potato production among the agro pastoralists. Amjath-Babu *et al.* (2016) stated that some of the crop production challenges are inadequate extension services at all levels, lack of modern farming methods, post harvesting losses and high dependence on relief food. The findings are presented as follows:

4.6.3.1 Economic Challenges Related to Sweet Potato Production

The economic problems that the agro pastoralists encountered were reported to be recurrent and extreme drought and inadequate inputs such as the sweet potato vines especially when they are ready for planting. This has contributed to low acreage of an average of 0.25 acre per agro pastoralist. Bulking and sharing of sweet potato vines by agro pastoralists to others was considered low which was due to the few vines grown. Unavailability of planting materials and their costs when need arise from agro pastoralists.

Human/wildlife conflict was further widely mentioned as a problem for the agro pastoralists. For instance, porcupines and wild pigs greatly damaged their crops, especially sweet potatoes. However, the key informants noted that some of these challenges were associated with lack of follow ups after the trainings regarding sweet potato production. The findings are consistent with those of Gurmu *et al.* (2015) and Belehu *et al.* (2004) who established that there are many challenges that face sweet potato production. They include economic, social, and ecological factors such as income, education, employment, community safety and social supports of that make poor small-scale farmers vulnerable to failure. On economic factors the key informants felt that agro-pastoralists value livestock keeping more than sweet potato production.

4.6.3.2 Social Challenges Related to Sweet Potato Production

On sweet potatoes production, extension staff perceived that agro pastoralists were taking more time in making of ridges as compared to digging holes for planting other crops. They also stated that since the crop was new to the community, it will take time for the agro pastoralists to appreciate it compared to crops like maize. This could have led to majority of agro pastoralists investing less in sweet potato production. The key informants attributed livestock dependence, which is also a way of life in Samburu County, to low production of

sweet potatoes. They noted that for sweet potato production to improve, more follow ups on the groups were important. This is particularly true of production for home consumption and for income generation. A study by Ali-Olubandwa *et al.* (2010) added that the extension services can be through results demonstrations, where two technologies are compared and method demonstrations, which are done to enhance a specific relevant technology required by participants, through model plots and group meetings. These are more effective in terms of time and services provided as compared to individual farm visits.

4.6.4 Suggestions by Extension Agents on Improving Sweet Potato Production

The key informants suggested establishment of demonstration sites of sweet potatoes. These plots could be managed by the County government under department of Agriculture and interested partners as training sites and bulking of sweet potato vines in the respective wards. The staff further suggested the need to facilitate provision of planting materials, which are highly nutritious, early maturing and disease and pest free. Regular follow ups after trainings were suggested as a requirement. Training on agronomic aspects of sweet potatoes was emphasized, especially on multi-purpose (as food, vegetable, livestock feed and income generator). According to Oywaya-Nkurumwa *et al.* (2011) extension personnel provide modern scientific methods of farming and keep farmers updated on new research development that is relevant to them.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter presents the summary of the study's findings, the conclusions arising from the findings, the recommendations and finally suggestions for further research.

The summary of the findings are presented in this section as guided by the objectives, which included: perception of agro pastoralists towards influence of social factors, perception of agro pastoralists towards influence of economic factors and perception of agriculture extension agents towards factors influencing sweet potato production by agro pastoralists. Descriptive survey design was used to conduct this study with a sample size of 100. The agricultural Poro ward, Samburu Central Sub- County was purposively selected as the study location because the agro pastoralist groups from the area benefited from distribution of sweet potato vines from World Vision organization. Data was collected through questionnaire administered to agro pastoralists, through FGD of opinion leaders and KII of extension agents. The data were also analysed both qualitatively and quantitatively.

5.2.1 Summary of Demographic Characteristics of the Respondents

Out of the sampled 100, 99 respondents participated in the study. Most of the respondents were female this might be the organization was working with formal groups, where women have formalized their groups compared to men. Majority of respondents were aged between 40-50 years. However, in terms of education levels, 63 percent had no formal education. This low literacy rate might have hampered adoption of new technologies, especially production of sweet potatoes. The family size reflected five to ten members per household which is an indication of availability of labour force for sweet potato production.

5.2.2 Sweet Potato Production among the Agro-Pastoralists

The findings revealed that 91.9 percent of the respondents were given variety SPK 004 of sweet potato by World Vision organization. On acreage of sweet potatoes 51.6 percent had 0.25 acre, on duration of production 43.56 percent planted sweet potatoes for four years and then 26.26 percent of them bulked and distributed each 20 vines to other agro pastoralists. The lower acreage and less bulking, which might be due to the drought and unavailability sweet potato vines after the drought.

5.2.3 Social Factors Influence on Sweet Potato Production

It emerged that most respondents were not trained on agronomic practices of sweet potatoes. World Vision has been working closely with line County Government staff on-site trainings. On other hand social factors were found to present less of the hindrances in agro pastoralism. Additionally, on sweet potatoes production, the crop was not associated with poor persons as earlier projected in the literature. However, in terms of value, it was shown that livestock keeping was more worth than sweet potato production. On extension services, the agro pastoralists agreed that they had enough personnel in the area to provide extension services. Most participants requested for more practical trainings on agronomic practices and utilization of sweet potato, as the crop is still new compared to other crops in the area.

5.2.4 Economic Factors on Influence Sweet Potato Production

Majority of the respondents interviewed did not plant sweet potato vines primarily as livestock feed rather human consumption. However, during drought, with limited livestock forage majority of respondents with vines opted to use the crop for livestock feeding. Data also showed that livestock was their primary source of income. Almost all the respondents concurred that their land system was communal. Despite that, they were allowed by the other community members to grow sweet potatoes on the land. This might have implications that livestock and wildlife roam freely in agro pastoralists' farms and sometimes destroy whatever was grown, especially during drought. This might imply that most of agro pastoralists will lose their crop, hence reduction of income at household level.

5.2.5 Perception of agriculture extension agents towards factors influencing sweet potato production

Extension agents interviewed were convinced on the benefits of sweet potato crop to agro-pastoralist as a future drought tolerant crop, which can be relied on because of frequent drought in the study area as most of other crops were rain-fed dependent. The extension agents also noted the preference given to livestock over crop farming as a contribution to low production.

However, in agreement with the beneficiaries and the community leaders, the extension agents noted that the practical trainings and extension services rendered to the beneficiaries was inadequate to equip them with the necessary skills to adequately adopt sweet potatoes. Most of the community members did not invest adequately in the crop since the crop was perceived to be new to the community. On this challenge, the extension agents collectively

suggested for the establishment of demo-plots for enhancement of plantings materials and long-term facilitation of logistics to ensure availability of extension services to agro-pastoralists, especially follow ups.

Other challenges raised that could have contributed to low production were extreme drought spell, inadequate inputs such as the sweet potato vines and human/wildlife conflict. To address some of the ecological challenges. The extension agents recommended for provision of planting materials, which are highly nutritious, early maturing and disease and pest free.

5.3 Conclusions

From the findings, several conclusions were made:

- i On social factors practical training on agronomic aspects and utilisation of sweet potatoes emerged as key issue due to low literacy level of the respondents. Extension agents trained the agro pastoralists on agronomic aspects of sweet potato, although the uptake is still low.
- ii On economic factors agro pastoralists preferred livestock keeping more than sweet potato production and were yet to perceive sweet potato production as an income generating activity. To increase production there is need for a dual- purpose crop where it can be used for home consumption as well as livestock feeds during drought.
- iii On perception by extension agents, it emerged that Samburu agro-pastoralists still depend on livestock for their livelihood. More practical trainings on dual purpose sweet potato production seems to be of priority as the crop is still new compared to other crops.
- iv The extension agents stated that due to frequent drought and maize crop failure, sweet potato was a very important crop because, it is a drought tolerant crop. They noted that the crop had multiple advantages that is it can serve as food supply, a vegetable, livestock feed and a rotational crop in pest/disease control process. It can also be an income generator if produced commercially. The extension agents further suggested that, to improve sweet potato production, establishment of vines bulking sites, demo plots and prolonged follow up extension services was necessary.
- v Challenges faced by agro pastoralists on sweet potatoes production as shared by agents were majorly prolonged drought, shortage of sweet potato vines, human/wildlife conflict and destruction of crops by livestock on communal land.

5.4 Recommendations

Based on the study findings, the following recommendations were made:

- i The County governments and their development partners should facilitate Samburu agro pastoralists of Samburu Central Sub-County to ensure extension services are more practical and more follow ups on sweet potato as a multipurpose crop due to low level of education of the respondents.
- ii Strengthening of agricultural extension services on promotion of sweet potato as livestock feed and an income generator to boost the economic livelihoods of the people in Poro ward Samburu Central Sub-County.
- iii An effective and efficient extension system to ensure acreage of sweet potato production is increased to meet food and nutrition security at household level as well as income generation. The system will deal with shortage of sweet potato planting materials, inadequate knowledge and skills on agronomic practices, utilisation of sweet potatoes, low acreage of sweet potato, pests, and diseases infestation. This will translate to better prices for agro pastoralists produce and increased income thereby increasing their purchasing power and improving their living standards.

5.5 Suggestions for Further Research

This study was limited to Poro ward of Samburu Central Sub-County, which should improve in future studies. It is vital for a similar study to be carried out in other counties, especially agro-pastoralists areas. This study was on, perception of agro pastoralists towards influence of social, economic factors and extension agents, other future studies can be done on commercialization of sweet potato as a multipurpose crop in agro-pastoral system.

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APPENDICES

Appendix A: Questionnaire for Agro pastoralists

Section I: Biographic Data

1. Gender

- a. Male
- b. Female

2. Age

- a. 18-28 years
- b. 29-39 years
- c. 40-50 years
- d. 51-61 years
- e. 62 years and above

3. Marital Status

- a. Married
- b. Separated/divorced.
- c. Widowed
- d. Single

4. What is your highest level of education?

- a. No education
- b. Primary
- c. Secondary
- d. Tertiary
- e. Others (specify)-----
--

5. What is your family size?

- a. Below 5 members
- b. 5-10 members
- c. 11-15 members
- d. 16 and above

Section II: Production of Sweet Potatoes

6. Which year were you given sweet potato vines by World Vision Organization?
(Please tick one)

- a. 2010
- b. 2011

7. Which varieties of sweet potato do you cultivate? (Please tick one)

- a. SPK 004
- b. Others, specify-----

8. How many acres do you have for sweet potato production? -----

9. For how long have you been producing sweet potatoes? (Kindly tick one)

- a. 2 years
- b. 3 years
- c. 4 years
- d. 5 years
- e. No response

10. Do you bulk sweet potato vines for other agro pastoralists?

a. Yes

b. No

11. If yes, how many vines did you distribute to them? (Kindly tick one).

a. 20

b. 30

c. 40

d. 50

e. Others-----

12. How many sweet potato vines did you give to each agro pastoralists from your farm?

(Kindly tick one

a. 0

b. 20

c. 40

d. 50

e. Others-----

Section III: Social factors and sweet potato production

13. Please indicate your level of agreement with the statements about social factors affecting sweet potato production. Rate the statements on scale of 1 to 5, that is 1=Strongly Disagree (SA), 2=Disagree (D), 3=Neutral (N), 4=Agree (A), and 5=Strongly Agree (SA).

		SD	D	N	A	SA
i.	It is against Samburu tradition to produce sweet potato					
ii.	Production of sweet potato is associated with poor persons					
iii.	I am looked down upon because of producing sweet potatoes					
iv.	I produce sweet potato because other people produce					
v.	I believe sweet potato has low yield compared to other crops					
vi.	Family members value livestock more than sweet potato production					
vii.	Production of sweet potato is more difficult compared to other crops					

viii.	Sweet potato does not form part of the family staple diet					
ix.	Sweet potato production cannot be done because no one has produced the crop in the neighborhood					
x.	Family members do not support sweet potato production					
xi.	Extension agents frequently visit and advice agro pastoralists on sweet potato production					

Section IV: Economic status and sweet potato production

14. What is the source of income for the family?

- a. Livestock
- b. Sweet potatoes
- c. Others

1. How many cattle do you keep yearly?

- a. 0
- b. 0-10
- c. 11-20
- d. 21-30
- e. 31-40

2. How much do you sell per cattle?

- a. 0
- b. 20,000
- c. 30,000
- d. 40,000
- e. 50,000

3. How many cattle did you sell per year? -----

4. Which is the system of your land? (Please tick one)

- a. Communal ownership-----
- b. Individual ownership-----

5. Suggest ways in which the agro pastoralists in Samburu County can be assisted, so that they can be more effective in sweet potato production?

Thank you and God bless for your cooperation.

Appendix B: Interview guide for Agriculture Extension Officers

LETTER OF INTRODUCTION

Dear Interviewee,

I am Leah Lepariyo, a postgraduate student at the Egerton University. As part of the requirement for the award of the Degree of Master of Science in Applied Community Development Studies and Extension of Egerton University. I am conducting academic research aimed at gathering primary data on the factors affecting sweet potato production by agro pastoralists in Samburu County; fortunately, your wards have been selected to participate in the study. You are therefore kindly requested to participate in the research study by answering the questionnaires provided for you.

Please be assured that the information you provide will be treated with all the confidentiality it deserves and at no time will your personal information be divulged.

Your cooperation is highly appreciated.

Thanks in advance.

Leah Lepariyo

M.Sc. Student

I: General information

1. Gender:

a. Male

b. Female

2. Age

a. 18-28 years

b. 29-39 years

c. 40-50 years

d. 51 and above

3. Ministry/Organization.....

4. Workstation.....

5. Designation.....

Section II: Information on perception, social factors, and challenges

- 6. According to your extension services, what are the social factors influencing sweet potato production among the community members? -----

- 7. What is the perception of community members towards growing of sweet potatoes? (Kindly explain). -----

- 8. What is your perception towards the production of sweet potatoes? (Kindly explain). ----

- 9. What are the challenges faced by agro pastoralists on sweet potato production (Kindly explain). -----
- 10. Suggest ways in which the people in Samburu can be assisted so that they can be more effective in sweet potato production? (Kindly explain). -----

Section III: Information on Economic factors

- 11 According to your extension services, what are the economic factors influencing sweet potato production among the community members?

Thank you and God bless for your cooperation.

Appendix C: Focus group discussion guide for Agro-Pastoralists

Focus Group Discussion on Sweet Potato Production

Promoting Sweet Potato Production to Enhance Food Security among Agro-Pastoralists in Samburu Central Sub-County, Samburu County, Kenya through Participatory Action Research

Objectives of the Focus Group Discussion

- i Identify social factors that influence sweet potato production in Poro ward of Samburu Central Sub-County.
- ii Describe the economic factors that influence sweet potato production in Poro ward of Samburu Central Sub-County.
- iii Establish perception of extension staff on factors influencing sweet potato production in Poro ward of Samburu Central Sub-County.
- iv To identify opportunities for increased adoption of sweet potatoes by the agro-pastoralist community in Samburu

I: Community Leaders Introduction

I welcome you all to this meeting. I am very happy that you were able to come. Our reason for inviting you to this meeting is for us to have a discussion on the growing of Sweet Potatoes in our ward. I want everyone to take part and give their opinions freely. All contributions will be appreciated as they will help us to understand the growing of sweet potatoes in our community.

- i Self-introduction of group members
- ii How much do you know about growing of sweet potatoes in your community?

Follow-Up Questions

a. Social factors and sweet potato production

- i How do you decide on whether you will grow sweet potatoes in your farm?
- ii What influences your family members about eating sweet potatoes?
- iii What do you not like about eating sweet potatoes?
- iv What do you like about eating sweet potatoes?
- v How easy is it for community members to share information on sweet potato growing with a neighbour?

- vi What do you think people in the community like most about sweet potatoes?
- vii What do you think people in the community do not like about sweet potatoes?
- viii Which are the community's beliefs about growing sweet potatoes?
- ix What name is given to sweet potato in the community?
- x How would the name of sweet potato influence its use in the community?

b. Economic Factors and Sweet potato production

- i Which is the market for sweet potatoes in the community?
- ii What is the price of sweet potatoes when you take them to the market?
- iii How does cost influence your decision to grow sweet potatoes?
- iv In what way can sweet potato growing increase your income?
- v How can sweet potato addition to your family diet reduce the amount of money spent on sourcing for food?
- vi How many people are needed for taking care of sweet potato in your farm?
- vii Which skills are required for growing sweet potatoes?

c. Opportunities for sweet potato production in Poro ward

- i What area of your farm have you put aside for growing sweet potatoes?
- ii What acreage of your farm would you want to have grown sweet potatoes?
- iii What is the likelihood that many farmers in the community will accept to grow sweet potatoes?
- iv What do you think about having sweet potato as an addition to the foods that are eaten in the community?
- v How can sweet potato growing be increased among the farmers in the community?
- vi What do you feel are the reasons that many farmers that may prevent the farmers in the community from growing sweet potatoes?

d. Framework for Enhancing Production and Utilization of Sweet Potatoes

- i Who do you think should be involved in promoting the production and utilization of sweet potatoes in our Sub- County?
- ii What would be the role of each of those you have suggested to be involved in sweet potato production?

Exit Question

Is there anything else you would like to say about growing and use of sweet potatoes in the community?

THE END

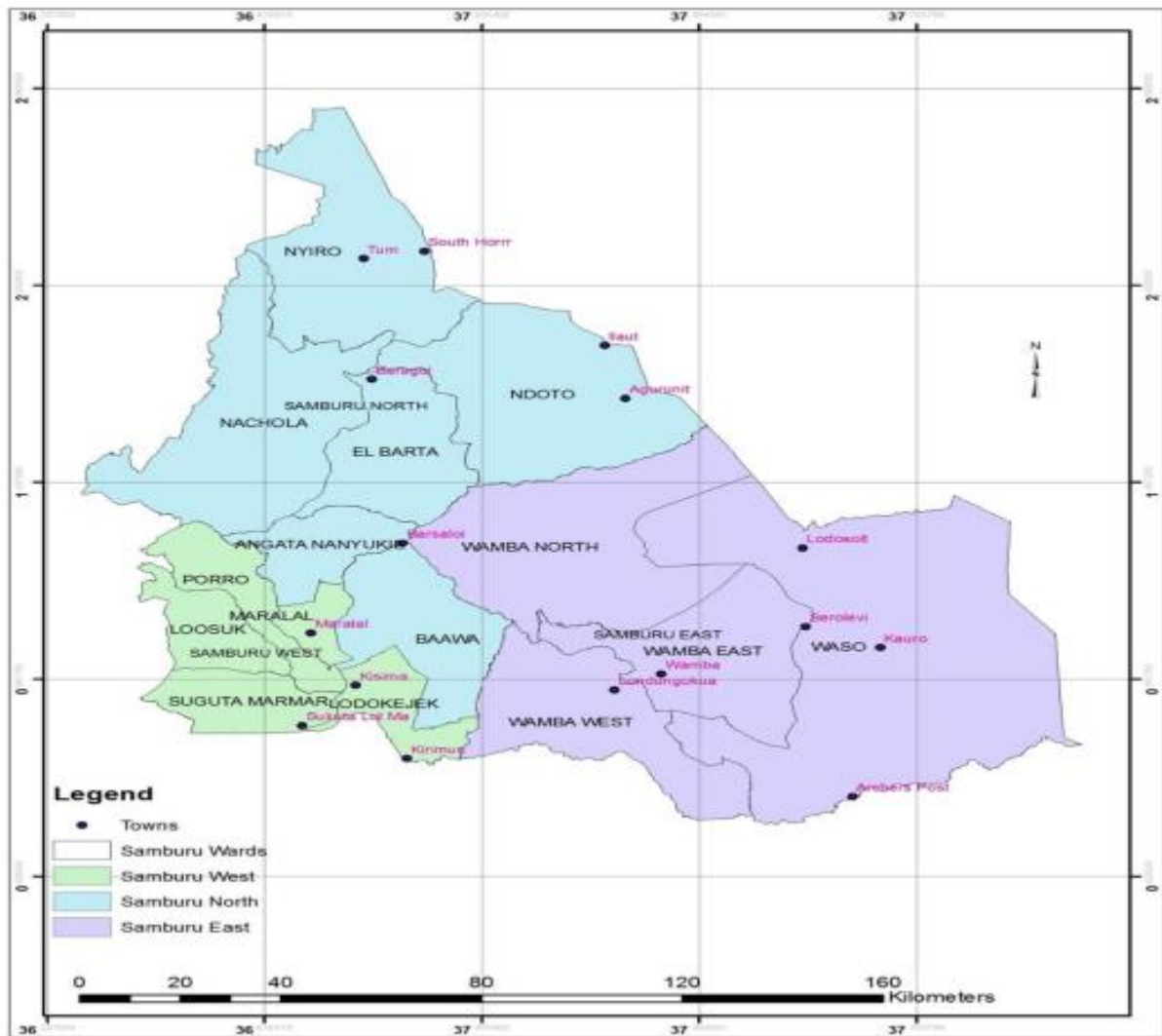
Thank you for your participation.

Appendix D : Kenya map



Source:<https://reliefweb.int/map/kenya/kenya-samburu-west-infrastructure-and-service-mapping-education-infrastructure-2-august>

Appendix E: Samburu County Map



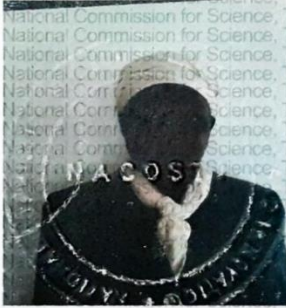
Samburu County is administratively divided into three sub-counties and 15 wards.

Source: <https://cog.go.ke/media-multimedia/reportss/category/106-county-integrated-development-plans-2018-2022?download=319:samburu-county-integrated-development-plan-2018-2022>


Appendix F: NACOSTI Permit

THIS IS TO CERTIFY THAT:
MS. LEAH CHEMUTAI LEPARIYO
of EGERTON UNIVERSITY , 183-20600
maralal,has been permitted to conduct
research in Samburu County
on the topic: SELECTED FACTORS
INFLUENCING SWEET POTATO
PRODUCTION AMONG
AGRO-PASTORALISTS IN SAMBURU
CENTRAL SUB-COUNTY KENYA
for the period ending:
17th January,2018


Permit No : NACOSTI/P/17/30477/14813
Date Of Issue : 18th January,2017
Fee Received :ksh 2000



Director General
National Commission for Science,
Technology & Innovation




Applicant's
Signature




Director General
National Commission for Science,
Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice



REPUBLIC OF KENYA



National Commission for Science,
Technology and Innovation

RESEACH CLEARANCE
PERMIT

Serial No.A 12501

CONDITIONS: see back page

Appendix G: Research authorization I



MINISTRY OF EDUCATION State Department of Education

Telegram: "EDUCATION", Samburu
Fax No: 06562413
E-mail: cdesamburu@gmail.com
When replying please quote

COUNTY DIRECTOR OF EDUCATION
SAMBURU COUNTY
P.O. BOX 327 - 20600
MARALAL

CDE/SBU/C/EXT/1/VOL 1/18

20TH JANUARY 2017

TO WHOM IT MAY CONCERN

**RE: RESEARCH AUTHORIZATION – LEAH CHEMUTAI LEPARIYO –
EGERTON UNIVERSITY**

Reference is made vide your letter Ref: NACOSTI/P/17/30477/14813 copied to this office dated 18th January, 2017.

The above named is expected to carry-out research in the community on "*Selected Factors Influencing Sweet Potato Production Among Agro-Pastoralists in Samburu Central Sub-County Kenya*" for a period ending *17th January, 2018.*

Please accord her the necessary assistance.

**ABDIKARIM I. MOHAMED
FOR: COUNTY DIRECTOR OF EDUCATION
SAMBURU COUNTY**

Appendix H: Research authorization II



REPUBLIC OF KENYA



SAMBURU COUNTY GOVERNMENT

DEPARTMENT OF AGRICULTURE LIVESTOCK AND FISHERIES
SAMBURU COUNTY

SBU/CDA/EDUC./VOL.I/4

County Director Agriculture
Samburu County
P.O. Box 183,
Maralal.

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION- LEAH CHEMUTAI LEPARIYO-EGERTON UNIVERSITY

Reference is made vide your letter Ref: NACOSTI/P/17/30477/14813 dated 18th January, 2017.

The above named is expected to carry out research in the community on "**Selected Factors Influencing Sweet Potato Production Among Agro-Pastoralists in Samburu Central Sub-County, Kenya**" for a period ending 17th January, 2018.

Please accord her the necessary assistance.

Stephen S. V. Engasia
FOR: County Director Agriculture
SAMBURU COUNTY



Appendix J: Publication



ISSN 2278 – 0211 (Online)

Influence of Social Cultural Factors on Sweet Potato Production among Agro-Pastoralists in Samburu County, Kenya

Leah Chemutai Lepariyo

M.Sc. Student, Department of Applied Community Development Studies,
Egerton University, Njoro, Kenya

Catherine Ng'endo. Munyua

Senior Lecturer, Department of Applied Community Development Studies,
Egerton University, Njoro, Kenya

Adijah Mukabana Olubandwa

Senior Lecturer, Department of Applied Community Development Studies,
Egerton University, Njoro, Kenya

Abstract:

The prevailing socio-cultural practices have the power to influence adoption of agricultural technology. Sweet potato is one of the world's highest yielding crops in terms of production per unit area, exceeding that of a major cereal like rice. The roots and leaves of sweet potatoes are consumed while its vines are used as animal feed in many parts of the world, yet it remains a survival crop which people eat, when they are starving. The main problem amongst agro-pastoralists is low production of the sweet potatoes. The aim of the study was to assess influence of social cultural factors on sweet potato production among agro-pastoralists in Samburu. Household-level surveys were conducted to obtain data from 100 agro-pastoralists purposively selected. Qualitative data were obtained through Focus Group Discussion and Key Informant Interviews. Data was analyzed using descriptive statistics such as percentages and frequency distributions. The Statistical Package for Social Sciences (SPSS) was used to analyze the data. The study found that agro-pastoralists had low literacy level. Overall majority of the agro-pastoralists at 89 percent strongly disagreed that community tradition was a hindrance to sweet potato production. The study demonstrated that tradition was not a barrier to the production of sweet potato. About 49 percent of them strongly disagreed and 45 percent also disagreed that production of sweet potatoes is associated with poor persons. Almost 68 percent of the respondents strongly disagreed, that they have been looked down because of cultivating sweet potatoes, while 27 percent of them indicated that they disagreed with the same statement. The results indicated that social-cultural factors do not hinder sweet potato production by agro-pastoralists. In conclusion selected social-cultural factors do not prevent sweet potato production by agro-pastoralists. On recommendation, more studies need to be done on commercialization of sweet potato cultivation. Due to low level of education of the respondents, practical demonstrations are a requirement to be considered.

Keywords: Influence, social cultural factors, sweet potato production, agro-pastoralists

1. Introduction

Sweet potato is one of the world's most important food crops and the amount produced is similar to or slightly higher than that of cassava. It is cultivated in the tropical and sub-tropical to temperate zones of the Far East and United State of America (U.S.A), making it world's number one tuber crop (Smith, Stoddard, Shankle, & Schultheis, (2009). It is also ranked seventh as world food crop and is likely to increase in importance in future due to its cultivation by farmers, who are facing chronic food shortage due to unreliable weather and falling purchasing power (Kuehne, lewellyn, Pannell, Wilkinson, Dolling, Ouzman, & Ewing, (2017).). It provides more edible energy per hectare than wheat, rice or cassava. Sweet potato requires fewer inputs and less labour than other staple crops. It tolerates marginal growing conditions such as dry spells and poor soils (Mohanraj & Sivasankar, 2014). This makes sweet potato particularly suitable as a crop for households threatened by diseases such as Acquired Immunodeficiency Syndrome (AIDS). The crop has an annual production of more than 100 million metric tons ranking thirteenth globally in production value among agricultural commodities (Truong, Avula, Pecota, & Yencho, 2018).

According to Vanclay (2004) adoption of practices that take place in a social context such as farming is not a technical activity, but a social-cultural practice, which becomes a way of life. Traditional beliefs, negative attitudes towards production, strong cultural systems, harsh climatic conditions and the worsening insecurity have largely contributed to low levels of community development (Samburu Pastoralists Livelihood Improvement Project, 2016). Despite the benefits associated with crop, production, access to communal land for production purposes among the pastoralists community is